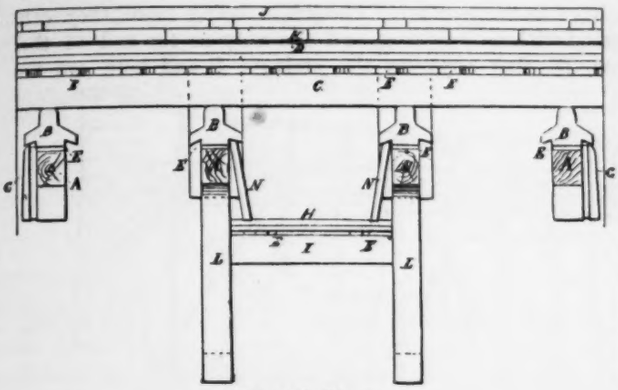
TRUSS BRIDGES.

The invention of Freedom Monroe is for the purpose of protecting the main timbers of a truss bridge from wet and dust from above, and thereby preserve them from decay.

The separate timbers are covered with roofing strips *B*



MONROE'S TRUSS.

and *D*. These strips are wide enough to lap well over the main timbers they are intended to cover. They are cut away on the upper side so as to present a comparatively small surface to the trusses which they are designed to support. Instead of being laid directly upon the timbers, the roofing strips are slightly elevated by the introduction between them and the beams or stringers of thin cleats *E*, which are set diagonally across the timbers and under the roofing strips. To prevent water dripping off the roofing strips into the cross-tie joints and braces, there are arranged diagonal "water tables" *N*, under the strips *B*, and are carried down to the roofing strip *H*, over the cross-tie *I*, which, being arranged the same as the other strips, throws the water clear of the timbers composing that part of the bridge.

The nature of David Hammond's invention (July 3, 1866), consists in a novel construction of a wrought iron arch of double T-iron combined with clamping pieces and a covering piece which excludes moisture, and also serves to prevent any lateral motion of the arch.

In detail the arch *B* is composed of two continuous pieces of double T-iron *b b*, which are set up parallel and at equal distance from each other, or a distance equal to the lengths of the clamps *D* or *P*. These clamping pieces are either double bolted as shown in Figs. 4 and 5, or single bolted as in Fig. 6. They have bolts *M M* at their sides which pass through the double T-iron and are secured by nuts on the outside, thus firmly connecting the two pieces of the arch. In the center of these clamping pieces is a hole *N*, through which pass the supporting rods *F* and brace rods *E*, the single bolted clamping pieces, by their peculiar construction, being allowed to rotate so as to accommodate themselves to the direction of the braces.

The covering piece *H* is placed on the top of the arch, and is attached thereto by the pieces *J*.

The suspension rods *F* pass through the clamps on each side of the chord pieces *a* and thence through the supporting piece *f*, forming a stirrup for the support of the girders.

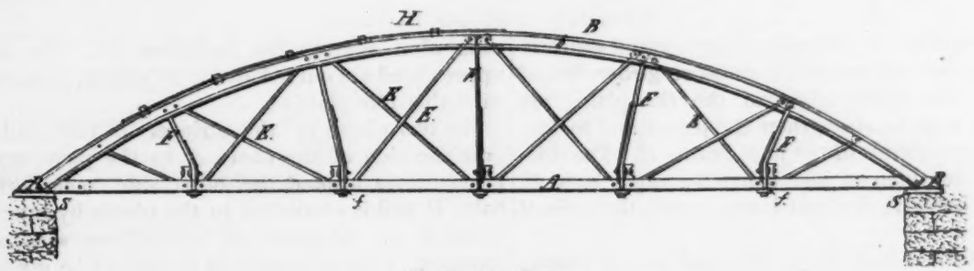
The object of the invention of David A. Mitchell (July 31, 1866), is to obviate the difficulties of bridging navigable rivers which have low banks and extended low lands at the sides, and, from their width and depth, or bottom, it is impracticable to build piers or trestle-work; so that ordinarily constructed draws cannot easily be placed and be made to operate over their channel.

By Mitchell's plan of suspending the draw a railroad bridge of any length and draw of any desired opening is constructed without building piers in the river, or near the channels.

The invention consists in hanging the draw on frame work, supported by cables suspended from towers, to allow steamers and other craft to pass under the bridge.

It also consists in forming a railroad track above or below the cable for trucks, from which to suspend a movable section of any desired opening. That part of Mitchell's invention which relates to the truss construction proper consists in the employment of collars or braces which hold the suspended frame-work in its place, thereby bracing it laterally and helping to equalize the strain upon the cables at all points, whether the draw is open or in its place for a train of cars to pass over.

The advantages of this mode of construction will be



HAMMOND'S TRUSS.

understood by those familiar with sections of the country where marshy, low lands extend a considerable distance from the rivers, such as the Mississippi and other navigable rivers of the South and West. In many places the bed of the stream is quicksand, and no good foundation can be found for building cribs, piers, or driving piles for trestle-work, so that to build the commonly constructed draws is wholly impracticable.

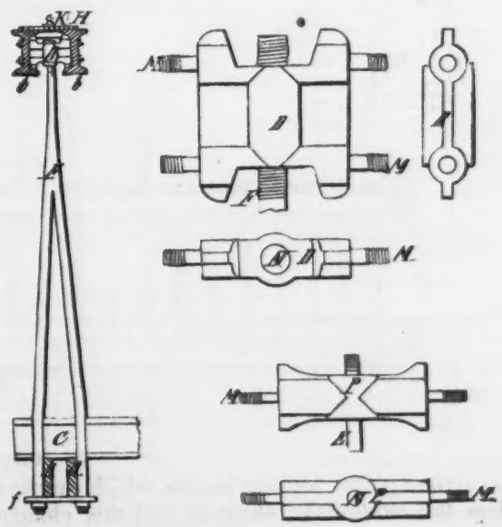


FIG. 6.

John H. Gilbert's invention (September 18, 1866), has for its object to furnish an arched iron bridge, so constructed as

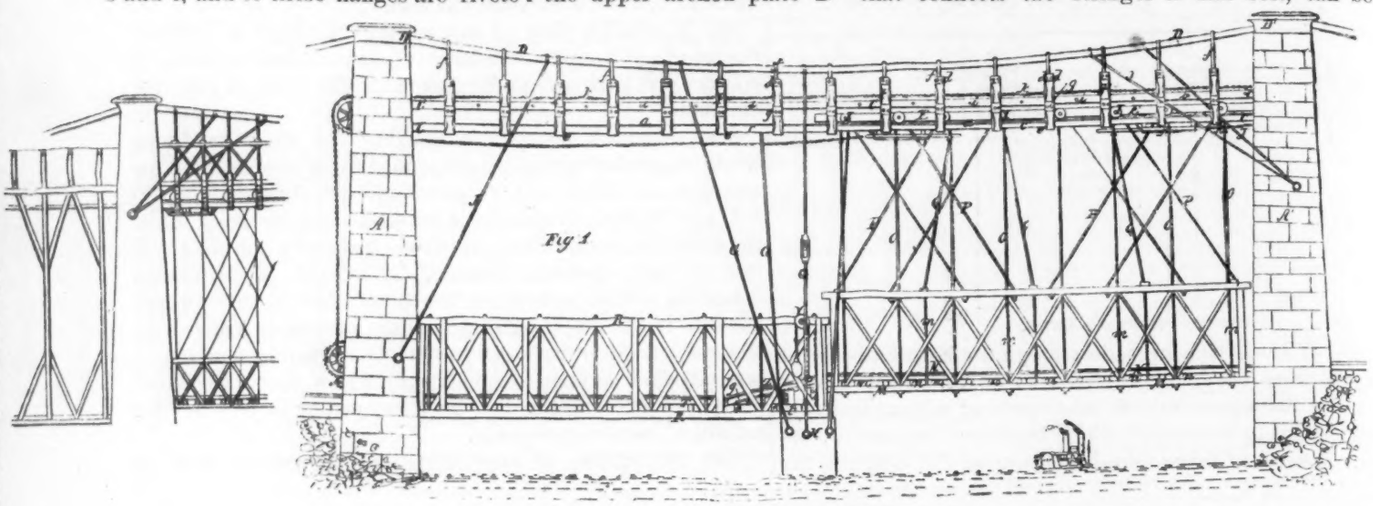
to produce a much stronger bridge out of a less amount of material than has heretofore been done. The arch is formed by combining the arched plates, side plates and angle bars with each other and with the floor-beams as follows:

B are the arched plates of the bridge, which extend from one end of the bridge to the other. The ends of these arched plates are turned up so as to form flanges, as seen in Figs. 3 and 4, and to these flanges are riveted the upper arched edges of the side-plates *C*. The side-plates extend continuously from the arched plates to the chord or girder line of the bridge. To the lower edges of the side-plates are riveted angle bars *D*, to strengthen the plates and to furnish a support for the ends of the floor beams *E* The side-plates are, moreover, pierced just above the angle bars *D*, and through the holes thus formed are passed the ends of the floor beams.

This bridge cannot deflect when subjected to a pressure, unless the arched plates kink or buckle, which cannot take place unless the side-plate *C* elongate, and this elongation of the side-plates is guarded against by their form and the angle bars *D*. Neither can the bridge twist or buckle laterally, for the greater the burden the greater is the tendency of the girders to keep in line until the crushing point is reached.

The patent of Zenas King is for an improvement upon the patent of Trees and King, October 1, 1861.

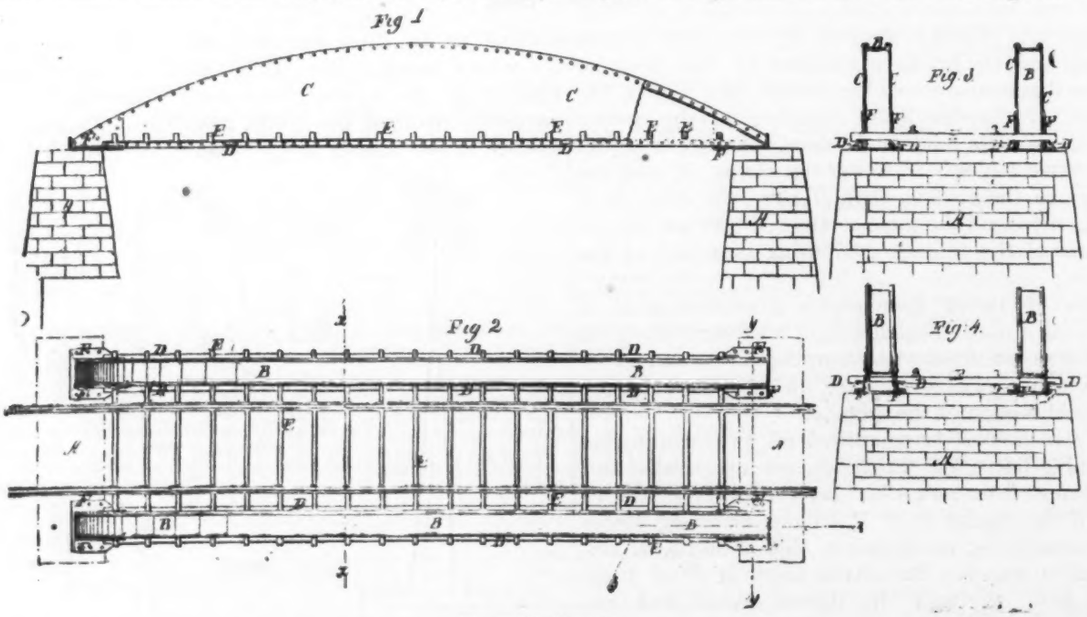
The upper chord *A*, is formed of sections, the inside pieces *a a* being of rectangular form in cross sections. The ends of the rods *C* and braces *D* are flattened and riveted between the two pieces of the chord *B*. The braces being connected by a hook and eye, allow the truss or bridge thus connected to expand or contract, according to the changes in the weather. The joints being loose, they can expand without breaking, and the nuts at the end of the plate *D'* that connects the stringer *B* and bolt, can be



MITCHELL'S TRUSS AND DRAW.

ends abut against the foot-plate *D'*. The ends of the upper chord are curved down as shown, to come in contact with this foot-plate.

The two pieces of the stringer *B* part, and one passes over the side of the chord *A* to the plate, and the other piece passes around the other side, each terminating in bolts *E*, and is connected to the plates by nuts *d*. loosened or tightened in accordance with atmospheric changes. If more tension is desired to be given the truss,



GILBERT'S BRIDGE.

it can be adjusted by the nuts, and by this means the floor can be raised if it sags.

The chord *A* is wider at the ends than in the center. The

October 21, 1866, Thomas W. H Moseley constructed a bridge truss made of thin plate iron, and which was found to possess great strength and stability. Moseley states that it can be constructed at very little expense in comparison to what is frequently expended for trusses of a like plan.

In the figures, *A* denotes the girder, which is made of plate

iron so as to have the form of a segment of a circle or an ellipse. The chord *B* is a long strip of metal, and is laid along the girder, where it is connected thereto by bolts *b* which pass through the two and through a series of hangers *a*, arranged against the inner face of the girder and projecting below it. In the formation of a bridge these hangers go down through a series of floor timbers *c*, which connect the trusses of the span and serve to support the flooring planks *d*. Rectangular strengthening plates *g* are riveted to projecting parts *f f*, the plates being placed flatwise against the girder-plate. There is also riveted to each side of the arched girder, and along its arc, an angle iron flange *C*, shaped in cross section, as seen in Fig. 2.

At each toe or end of the truss is a shoe *D*, consisting of a sheet of plate metal bent at right angles. These shoes rest on the abutments or pieces *E*, and each is secured to the truss by two bolts *R*, which are connected and extend from the truss, and pass through the vertical part of the shoe. These bolts serve to adjust the truss by springing or drawing it laterally in either direction as occasion may require.

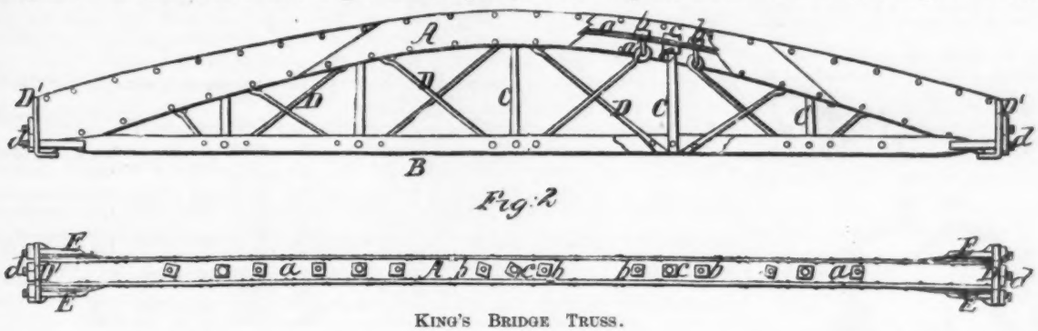


Fig. 2

KING'S BRIDGE TRUSS.

UNDERGROUND TELEGRAPH WIRES.

THE WORK OF A COMMITTEE WHICH PROPOSES TO DO AWAY WITH THE POLE SYSTEM.

Notwithstanding the fact that the Western Union Telegraph Company is not represented in the General Committee on Underground Communication which has been formed in this city, there is a very formidable array of electrical interests combined to solve the problem of removing from the streets and buildings the unsightly, if not dangerous, poles and wires which now cover the lower part of the city as with a vast spider's web. Citizens loudly complain of the injury to the roofs of buildings caused by the attachment of many wires, and householders long ago lost patience with the never-ending visits of linemen and trouble hunters. This has led to the formation of an organization of twenty-five electrical companies, exclusive of the Western Union, who propose to remove the obnoxious wires and poles and replace them with an underground system by which every house may be supplied with every form of electrical communication without delay, at moderate cost and with infrequent disturbance of the street pavement.

The General Committee consists of Gov. Cleveland; Mayor Edson, Henry L. Bailey, electrician of the Time Telegraph Company; Albert L. Chandler, President of the Fuller Electrical Company; William A. Childs, manager of the Law Telegraph Company; Henry Cummins, Vice President of the Postal Telegraph Company; Leonard E. Curtis, Secretary of the United States Electrical Lighting Company; Joseph P. Davis, Vice-President of the Metropolitan Telephone and Telegraph Company; Sherburne B. Eaton, President of the Edison Electric Lighting Company; Charles R. Flint of the Weston Electric Light Company; Rowland R. Hazard, President of the Gramme Electrical Company; Edwin Holmes, President of the Burglar Alarm Telegraph Company; C. B. Hotchkiss, Vice-President of the Mutual District Telegraph Company; William M. Ivins, President of the Jablochkoff Electrical Lighting Company; Frederic H. May, General Manager of the American Rapid Telegraph Company; Thomas L. Montgomery of the Brush Electric Company; Henry Morton of the Electrical Accumulator Company, Garret S. Mott, General Superintendent of the Bankers' and Merchants' Telegraph Company; Henry W. Pope, Vice-President of the Manhattan District Telegraph Company; Charles W. Price, Manager of the Baltimore and Ohio Telegraph Company; Augustus C. Richards, Treasurer of the Automatic Signal Telegraph Company; J. Elliott Smith, Superintendent of the City Fire Department Telegraph, and Elihu Thompson Electrician of the Thompson-Houston Electric Company.

This committee is divided into various sub-committees for the promotion of the end sought. Prof. Henry Morton is Chairman of the Committee on Electrical and Mechanical Devices, which has under consideration about 400 patented devices of more or less value and utility, which deal with insulation, induction, mechanical arrangements for extension and contraction, the support of conductors in the conduits, the discharge and conduction of surplus electricity, and so on. It will be the duty of the committee to ascertain which of these devices will be necessary to accomplish the object sought, and much work has already been done in that direction.

There is a Committee on Law and Franchises, of which the Chairman is Sherburne B. Eaton, and a Committee on Business Organization, of which Rowland R. Hazard is Chairman. The general Secretary of the organization is William C. Behrens.

It is agreed that the wishes of the public and the interests of the corporations may be alike promoted by underground wires. It is proposed to ascertain the most practicable plan, and to have compulsory legislation, requiring all electrical companies to conform with that plan; and it is intended to make the plan so obviously the best, that not even the powerful influence of the Western Union Telegraph Company can prevent the enactment of such a law.

In the furtherance of the plan the committee has already distributed circulars concerning the subject to electricians and scientific men, in this country and abroad, with the object of concentrating the inventive genius of the world upon the problem. The following are the principal suggestions which have been made as to the difficulties which remain to be surmounted before the problem of underground wires can be solved.

It is required that the conductors or wires of the telephone system, of the several different systems of telegraphic communication, and of the several systems of arc and incandescent electric lighting (systems greatly varying in electromotive force used and in character and strength of current) be laid in a single conduit, or way, and—what is absolutely essential—in a manner so as to be inductively independent of each other and free from retardation.

The conduit or electric way must be of large capacity—say from 2,000 to 5,000 wires—and of a practicable form and size in cross-section. If naked wires are employed, moisture must be excluded from them and from all connections. If insulated wires are used, the character of the insulation will determine the necessity of exclusion of moisture. The details of construction must be such as to permit, without removal of the pavement, immediate connection, or repeated changes with every house or building for all kinds of electrical service, access for repairs and testing, and the laying of additional wires and their removal.

DIRECTIONS FOR MAKING PORTLAND CEMENT.

BY D. O. SAYLOR.

In order to make Portland Cement, it requires a homogeneous mixture, containing, in proper proportions, carbonate of lime, alumina, silica and iron. This mixture must be subjected to a heat sufficiently high to produce a vitrified, dense and heavy clinker, whose specific gravity, when ground fine, should not be above 3.

In order to produce *pure* Portland Cement, it is necessary that the manufacturer rejects all the under-burnt and the pulverulent material, and carefully select only the vitrified clinker. The under-burnt contains free lime, and is light in weight; and the pulverulent is the over-burnt clinker, which falls to a fine powder the moment it comes in contact with air, and both should be rejected as foreign matter.

It is impossible to regulate the draught of the kiln so as to burn the material alike, and to a proper degree of calcination. Some manufacturers grind the contents of a whole kiln together, under-burnt, over-burnt, as well as the good clinker, producing a cement weighing about 108 lbs. per bushel, feeling fine and soft to the touch.

Properly burnt and well selected Portland Cement clinker, when ground so as to pass 90 to 95 per cent. through a sieve of 2,500 meshes to the square inch, will not weigh less that 118 lbs. to the bushel, and feels hard, sandy and coarse, when compared with the other containing the foreign matter, when ground much coarser.

Light weight cement will test well in the popular "seven day test." The free lime, however, arrests the chemical action necessary to crystalize and harden the mortar, and it will never attain that stony hardness that pure, heavy cement will, and at the expiration of a few months, if it does not disintegrate, will be as hard as it will ever get, while pure Portland Cement, as General Gillmore says, in his valuable book on lime and cement mortars, will "continue to harden for ages."

The induration or setting of Portland Cement, consists in the formation of a real mineral, of a crystaline rock species, which appear to be analogous to natural zeolites. This fact can be confirmed by microscopic examination of Saylor's Portland Cement. The set will be found to consist of translucent, and to some extent, even of transparent crystalline particles of different forms, exactly like those of the zeolites of nature.

It is evident and a settled fact among chemists, that in the induration or setting (especially under water) of cement containing free lime, that no crystallization takes place, but will form an amorphous mass, often penetrated by cracks and fissures, so frequently seen in constructions composed of cement.

THE CURTIS EXPANSION TRAP.

We represent below (in section) the expansion trap recently perfected by the Curtis Regulator Co., of 55 Beverly st., Boston. This is an improvement on their *float* trap, so as to adapt it to high pressure and to enable the steam user to utilize the enormous amount of heat well known to be latent in water above the temperature of 212°. One *very* important feature of this trap is its capability of discharging *air* in large quantities; as air, unlike steam, can part with its heat without reducing its bulk. By the use of a float, trap water *must* be discharged as soon as it enters the trap, *regardless* of its *temperature*, while in the above-described trap the water is retained until its temperature is reduced to 212° or below, at the will of the operator, and a great economy effected.

Cold air opens the expansion trap as certainly as cold water, and, as when steam is let on to the pipes it drives the air before it, this air being cold is all expelled before steam can reach the trap to close it.

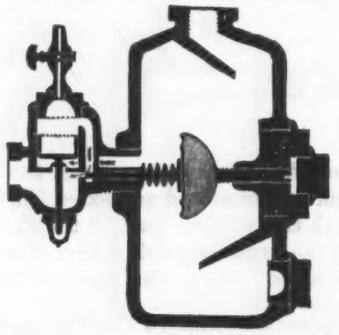
The operation of the Curtis Expansion Trap is as follows: The sectional view shows a main valve, lifted by a very loose-fitting piston, a passage connecting the top of the piston with the *outlet;* a very small valve controlling that passage (by means of an expansion vessel and a stiff spring), and a mud-drum, which can be cleaned by taking off the lower cap.

The principle upon which it works is the change of pressure on the top of the piston, the pressure

underneath remaining constant (being the same as the pressure in the trap).

The operation is as follows: The trap is cold, and the flexible surface of the expansion vessel is pushed back by the stiff spring, thus opening the small valve. The opening of this valve connects the top of the piston with the outlet (*under* the seat of the main valve), and relieving the pressure on top of the piston, permits the pressure underneath to raise the outlet valve for a free discharge.

Steam being let on, all the *air* and *water* in the pipes flows out freely, until the temperature of the water reaches the point at which the trap is set to close. At this point the expansion in the vessel is sufficient to force the secondary valve toward its seat. This restrains the flow of water through the connecting passage, thereby increasing pressure on *top* of the piston; which pressure forces the outlet



valve toward its seat, and diminishes the flow of the water, delivering it *only* at the temperature at which the trap is set to deliver. The cap at the back can be taken off while pressure is on, and the degree of temperature raised by turning *back*, with a screw-driver, and lowered by turning *forward*.

What is claimed for it is:

1. It will fully control the outlet valve on a change of temperature of 5°.

2. The outlet valve has an area nearly equal to the area of the connecting pipes, and is on the outside of the trap.

3. It will discharge *air* as freely as water, and will remove *large quantities* of air as fast as the steam will displace it.

4. It has no glands, friction, or packing. Any trap will work from 1 to 100 lbs. pressure.

5. It has a mud-drum to catch sediment, and an opening to remove it, and it is *small, simple, durable* and *accessible*.

THE TORPEDO BOAT DESTROYER.

One of the assistants of Mr. Ericsson, the inventor, says: "The Destroyer is a marvel of mechanical compactness and power. She is 130 ft. long, carries a gigantic gun that is 30 ft. long, and yet has in her hold, all below the water-line, the most powerful marine engines known. There are nine separate engines all within that space, and none of them is near enough to the surface of the water to be reached by modern armament. The Destroyer can travel at a rate of speed that would exceed that of Jay Gould's yacht, if her strong engines were urged to do so. Her regular speed is 17 miles an hour through almost any waters, and when going at the rate of 13 miles an hour her strong engines will turn her about abruptly within her own length. The destructive power of the explosives that will be put into the torpedoes intended for the Destroyer's use will be equal to 500 tons of powder. The gun on the Destroyer will send a torpedo 900 ft. in two seconds. The trials already made have demonstrated that a fast craft, going at full speed, could not escape the torpedo if the range is accurate. The purpose of the tests now with the gun will be to discover exactly how much the course of the torpedo through the water is varied by the action of tides or other influences. That is the great problem with us. Shooting torpedoes under water is an untried science as yet, and proficient gunners in that business must be educated to its requirements. All armor-plated ships have their armor from two to three feet below water-mark only. Their draught of water varies, however, and it is to accustom the gunner to make accurate ranges for such variations that we are now practicing. The torpedo does not come into view before striking the object aimed at, but goes through the water 10 ft. below the surface. A long net is used for the target. The dummy torpedo goes through it, and by estimating the location of the holes made we know the exact deflections, horizontal or lateral, made by the torpedo during its passage from the gun to the net. We will shoot at a 900-ft. Mr. Ericsson has only been on board the Destroyer once. He works entirely from drawings and knows precisely how every piece of machinery on board of her should look."

SOUTH PENNSYLVANIA R. R. TUNNELS.

Name.	Length.	Quantities in west approach.	Quantities in tunnel.	Quantities in east approach.	Date of completion.	Location.
		C. yd.	C. yd.	C. yd.		
Blue Mt.	4,350	E. 3,550 Lr. 3,000 Sr. 12,000	90,000	E. 4,614 Lr. 4,000 Sr. 12,000	March 1, 1885.	44 miles west of Harrisburg. 14 " " Newville.
Kittatinny Mt.	4,635	E. 3,666 Lr. 3,000 Sr. 20,000	95,200	Sr. 6,860	March 1, 1885.	45 miles west of Harrisburg. 15 " " Newville.
Tuscarora Mt.	5,400	E. 9,786 Lr. 9,000 Sr. 15,000	112,120	E. 6,147 Lr. 6,000 Sr. 16,000	June 1, 1885	56 miles west of Harrisburg. 2⅛ " east of Burnt Cabins.
Sideling Hill	6,700	E. 6,677 Lr. 6,000 Sr. 25,000	143,250	E. 7,740 Lr. 9,000 Sr. 15,000	Sept. 1, 1885.	74 miles west of Harrisburg. 17 " east of Everett.
Ray's Hill	3,620	E. 3,353 Lr. 3,000 Sr. 17,000	81,720	E. 5,402 Lr. 5,000 Sr. 15,000	Dec. 1, 1884.	79 miles west of Harrisburg. 12 " east of Everett.
Allegheny Mt.	5,000	E. 24,348 Sr. 18,860	128,700	Sr. 16,436	July 1, 1885.	127 miles west of Harrisburg. 14⅛ " east of Somerset.
Laurel Hill	5,450	E. 38,465 Lr. 6,273 Sr. 12,547	110,000	E. 27,260 Lr. 17,008 Sr. 35,817	June 1, 1885.	155 miles west of Harrisburg. 13⅛ " " Somerset.

NEW YORK, Aug. 21. 1883. OLIVER W. BARNES, Chief Engineer.

Bids for the above work (which have already been advertised in this journal) were received up to noon yesterday. It is expected that there will be a large number put in. The list will be published next week, if given out. The grading contracts for the whole roadbed will be ready for letting some time this fall; it was deemed desirable to get the heavy tunnel work started. This road is evidently going to be one of the best constructed in the United States; the preliminary surveys have been quite extraordinary in their variety and completeness; an immense tract of mountainous region has been very thoroughly explored and contoured, and the drawings now in the office of the company cannot probably be equaled by any of similar character in the country. We expect to be able to give as early and complete information respecting the progress of this great undertaking as can be obtained.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.

(*Continued from page* 401.)

DLVI.—LINDSAY, ONT.

Lindsay, Ontario, in lat. 44° 20′ N., long. 78° 45′ W., is on the Scugog River. No information can be obtained as to the date of settlement. Water-works were built by the town in 1874, taking the supply from the Scugog River and pumping directly into the mains by two Holly pumps driven by two 52 in. turbines under 6½ to 8 ft. head. The ordinary pressure is 50 lbs., and fire pressure 85 to 140 lbs.

Distribution is by 4 miles of cast iron pipes of 8 and 6 in. diameter, with 12 fire hydrants.

No further information can be procured. The population is 5,080.

DLVII.—VERGENNES, VT.

Vergennes, Vermont, in lat. 44° 10′ N., long. 73° 20′ W., is on Otter Creek, 6 miles from Lake Champlain.

Settled in 1766, it was incorporated a city in 1788. Water-works were built by the city in 1869, taking the supply from Otter Creek and pumping it directly into the mains by piston pumps driven by water power. The pumping machinery consists of 2 Flanders pumps built by the Vergennes Machine Company. The water is filtered through sand and gravel. No description of the filter bed is furnished. In 1879 distribution was by 3½ miles of cast iron pipe of 8 to 4 in. diameter, with 31 fire hydrants. No later returns have been received, and the number of taps is not known.

The population in 1880 was 1,782. The daily consumption is not known.

The works cost $80,000 and the bonded debt is $58,000. The works are managed by 3 Water Commissioners elected annually. No financial statistics are given, nor the names of the officers.

DLVIII.—PERTH AMBOY, N. J.

Perth Amboy, New Jersey, in lat. 40° 30′ N., long. 74° 15′ W., is on level ground at the mouth of the Raritan River, on Raritan Bay.

Water-works were built by a private company in 1881, taking the supply from springs in a ravine about 1¼ miles from the town, where a reservoir of 20 million gallons capacity is formed, from which the water is pumped by Blake steam pumps into a plate iron stand-pipe 20 ft. in diameter and 80 ft. high. There are two pumps, one driven by a duplex condensing engine, and the other for fire purposes by a non-condensing engine. Each is of 1,500,000 gallons daily capacity.

Distribution is by 6½ miles of cast-iron pipes, of 12 to 4 in. diameter. The number of hydrants and taps is not given. The capital stock of the company is $100,000 and the bonded debt $66,000. No other information can be obtained.

The population in 1880 was 4,808.

DLIX.—MARQUETTE, MICH.

Marquette, Michigan, in lat. 46° 30′ N., long. 87° 35′ W., is on a bluff 25 ft. above Lake Superior, and is the principal shipping port of the Lake Superior iron region.

Water-works were built for the town in 1870 by the Holly Manufacturing Company, taking the supply from Lake Superior.

A double cylinder steam-engine of 14-in. cylinders, with 24-in. stroke, drove a gang of six single-acting 6-in. bucket pumps, and also a rotary pump for fire purposes. Another engine of 18-in. steam cylinder and 24-in. stroke drove a gang of eight double-acting bucket and plunger pumps of 12-in-bore and 12-in. stroke.

Water is pumped directly into the mains with ordinary pressure of 80 lbs. and fire pressure of 120 lbs. In 1878 distribution was by six miles of cast-iron pipe of from 12 to 3-in. diameter, with 53 fire hydrants and 29 gates. The number of taps is not known, and no information can be obtained concerning the works for five years past. The works cost $70,000.

DLX.—MUSKEGON, MICH.

Muskegon, Michigan, in lat. 43° 15′ N., long. 86° 15′ W., is on the Muskegon River, near Lake Michigan.

Water-works were built by the city in 1874, taking the supply in part from a well 30 ft. in diameter and 15 ft. deep, and in part from a branch of the river, and pumping directly into the mains by a steam pump built by the Vergennes Machine Co. In 1882 additional pumps were erected by M. Walker. The ordinary pressure is 45 lbs., and fire pressure 100 lbs.

Distribution is by 15 miles of cast-iron pipe of 16 to 6 in. diameter. In 1879, the date of the latest information that can be obtained, there were 158 fire hydrants and 83 gates. Service pipes are of wrought iron.

The population in 1880 was 11,264. The daily consumption is not known, nor can any statistics be procured from the officers of the works. The works cost $160,000.

THE "DESTROYER."

The torpedo boat now being experimented with in the Lower Bay is aptly named, and, we prophesy, is destined to work as great a revolution in naval warfare as did the "Monitor," the offspring of the same fertile brain. Ericsson, after inducing the world to abandon the "wooden walls" of song and story, and to invest many millions in huge, unwieldy iron-clad monsters, now invents a "Destroyer" of the very navies his genius brought into existence.

With many thousand miles of sea-coast to defend in case of war—supposing war to be a necessary, or at least an unavoidable evil—it is destroyers that we want. As a defensive measure we know of nothing equal to the dreaded uncertainty, the unexpected destruction wrought by a torpedo—whether anchored in the stream or projected from a gun. It is a power that no human agency can effectually guard against.

There is a remnant of romance, a fragrant memory of naval heroes and days gone by; there is

"glory" in doing battle with a ship of equal strength, even though the sides be now plated with many inches of iron; and each gun hurls a mass of metal equal in weight to a broadside from a line-of-battle ship of Nelson's day. In such a case it is still a question of gun against armor, and of ship against ship. But when we find opposed to us a vessel like the "Destroyer," the conditions change; there is little "glory" in being struck by a blow "below the belt," against which we can provide no practicable defense; a blow dealt by an opponent insignificant in size, but fleet; too small to be struck by our shot, and moreover as heavily armored as ourselves at all vulnerable points; with no display of guns or any of the paraphernalia that make up the traditions of naval warfare, and yet containing a destructive power equivalent to the explosion of 500 tons of powder against the unarmored portions of our hull, the part under water, which naval constructors have heretofore considered sufficiently well guarded, and which the laws of flotation forbid our loading down with armor-plate, even could an armor be invented to neutralize so terrific a shock.

If men must fight in ships, let the business be done quickly; the more terrible the mode of destruction and the more certain the death, the less attractive to the average mortal will be this method of employment. The moral effect of torpedo *vs.* iron-clad is not the least advantage to be considered. Man, generally, fears the unseen, and the bravest commander will approach with a proper dread a coast or harbor, where this hidden torpedo-devil may lie in wait beneath a peaceful-appearing but treacherous water surface; or perhaps lurking behind some sheltered point, ready to rush at him with a yacht's speed and send him to the bottom at one fell blow.

Taking the subject from an economical point of view, torpedoes and torpedo-boats again have the advantage. The cost of one first-class iron-clad would supply enough of the cheaper engines of destruction to protect many miles of coast. Since 1861 the makers of guns and the makers of armor-plate have been striving each to outdo the other; one builds a plate, the other constructs a gun to crush it; each result requires a still greater outlay to counteract it. The end must be near at hand, for there is a limit to the mass that can be attached to the sides of a vessel and still permit that vessel to float, and to the tenacity of metals and the power of explosives. The days of "floating fortresses" are, we believe, numbered; they will be useless even to batter down the other forts which occupy their proper position on land, when the defenders can send torpedoes against the iron-clads, and the armor above the water-line will not protect against the blow below that level.

The "navy of the future" will be made up of fleet ships, heavily armed as to guns, but depending on speed for the protection of their hulls from danger. Commerce and the demands of uncivilization still require a navy, but we will again have a navy differing only in the detail of engines instead of sails, and 200-lb. shot for a "20-pounder," from the navy of old.

TRANSACTIONS OF THE INSTITUTION OF CIVIL ENGINEERS.

The last excerpt minutes received from the Institution are as follows: "Summit Level Tunnel of the Bettws & Festiniog Railway," by Wm. Smith; "The Introduction of Irrigation into New Countries as Illustrated in Northeastern Colorado," by Patrick O'Mera; "The Electrical Transmission and Storage of Power," by Dr. C. William Siemens; "Hydraulic Machine Tools," by Alexander McDonnell.

The paper first named, on the Festiniog Tunnel, is more interesting from the discussion which it gave rise to than from anything new or of interesting detail given by its author. The tunnel was 3,860 yards long, through hard bastard slate. The rock drilling was principally done by machinery driven by compressed air, and the machines used were Ingersoll, McKeon and Burleigh drills, all mounted on carriages. No water of any amount was met with, a rather remarkable experience in so long a rock tunnel. The dimensions of the tunnel were 18½ ft. high, by 16½ ft. wide; there were three shafts. The total cost of the tunnel and shafts complete, including labor, plant, materials, etc., amounted to £302,850 ($1,514,250), or $392.28 per lineal yard. The cost of labor alone was $263 per yard; of plant, $33 per yard. The removal of the rock cost about $12 per cubic yard. Among the special regulations adopted in this tunnel, we find one especially forbidding "the use of any other kind of tamping rod than a wooden one;" and another, prohibiting any "hammering or violence of any kind" in tamping a charged hole, or in working about a "missed hole;" a rather unnecessary ruling, it strikes us, among miners, who generally understand that dynamite is not a material that can be safely treated with violence.

The paper, in fact, describes an every-day tunnel, without any remarkable features except its extravagant cost, a feature generally noted in the discussion. Mr. Eckersley mentioned that the Mont Cenis Tunnel cost about $10 per cubic yard for excavation; and the St. Gothard about $8.50, and that many English rock tunnels that he knew of cost from $1.75 to $5.50 per cubic yard.

Col. Beaumont stated that the excessive cost was due to the slow rate of speed made in drilling, which averaged only 14 ft. per week (the work was done by day's labor, not by contract); to drive cheaply with machine drills a rapid speed was necessary. In the Keighley Tunnel he had driven a heading 7×8 ft. with machinery, at an average speed of 105 ft. per week for five weeks; and through hard limestone he had reached 60 ft. per week in a level of similar dimensions to the Keighley heading. Col. Beaumont believed that the most rapid progress ever made in rock excavation was by the circular-cutting machine used in the Channel Tunnel (described in the ENG. NEWS); the heading was 7 ft. in diameter through chalk; the greatest distance driven in 24 hours was 78 ft., and the greatest speed attained was 8 ft. in 80 minutes, or one foot in ten minutes. The same machine is now at work under the Mersey River; it is in harder rock, and the speed is reduced from ½ in. forward per revolution to ⅜ in., and the number of revolutions from three to two per minute. He believed the system would work well in all ordinary limestone and sandstone.

Mr. E. Woods, Vice-President, was disappointed in finding no record in the paper of the relative performances of the three kinds of rock-drill employed. He, too, thought the cost excessive. He had himself made a tunnel within the last few years of almost the same dimensions, at a cost of $6.75 per cubic yard, all in solid rock, and the work done by hand-drills only. He notes the labor cost as excessive on the Festiniog Tunnel. With the machinery used it should have been much less; he agreed with Col. Beaumont that the progress had been too slow.

Mr. Geo. Chatterton, in referring to his own work, the main drainage at Torquay, said that he drove a tunnel, 7 ft. in diameter and 4,564 ft. long, through very hard rock with the Ingersoll rock-drill, and it cost about $8 per cubic yard. He thought the whole question was one of transmission of power in using machinery. He thought 50 lbs. per sq. in. at the compressor too low—as used at Festiniog. He did not think drills could be worked economically under 60 lbs. at the drill; he thought there was too much loss by friction in carrying compressed air so long a distance as at Festiniog in a 2½ in. pipe.

Mr. McGregor, formerly Resident Engineer at Festiniog Tunnel, did not think there was really much difference between the McKeon, Ingersoll or Burleigh drills, it being granted that they were of the same material and workmanship. The McKeon drills used were made of phosphor-bronze, while the others were of cast iron, the relative cost being as 2 to 1; the men would not use automatic feed on the McKeon drill, and the machines were eventually sent to their work without this appendage. Mr. McGregor described a little machine used by him in transferring the center line from the surface to the bottom of the shaft. Two of the shafts were 450 ft. deep, with a working length of 10 ft. across the top of shaft. Water, oil and tar were used to steady the line of the 10 lb. plumb-bobs, but were found insufficient. He finally used at the bottom of the shaft two needles, each 9¼ in. long, with the fulcrum twice as far from the point of the needle as from the butt. Each needle was mounted like a compass needle, and the two were fixed upon a single board. The butt-end of each needle was forked, leaving a slot 1½ in. long by ⅛ in. wide, and in this slot slid very easily a block of brass, through which one of the plumb lines passed. The board carrying the needles was now set on a line coinciding with the axis of the tunnel in general direction, the two plumb lines were passed through their respective blocks in the butt of the needles, and the oscillations of the points noted, the amount of oscillation carefully divided and the whole board shifted until these points found coincided with the line of the pivots. Then the board was firmly clamped down, the amplitude again divided very carefully, and the needle fixed, after which either of the plumb lines could be removed for the purpose of correctly setting the transit instrument in the plane of the two lines.

THE UNION HYDRAULIC WORKS OF PHILADELPHIA.

This firm of I. S. Cassin & Co., of Philadelphia, have issued an illustrated circular that has a value beyond that of a mere advertisement of their works. It shows, correctly drawn and tinted, nearly seventy different forms of pipe connections, valves, water columns, hydrants, etc.; in fact, a number of most useful forms of "special castings" entering into the daily practice of the hydraulic engineer.

To the expert, who has gained his wisdom by years of experience, illustrations like these may be of little service, but to the beginner, who will seek in vain in books for information of the kind, these practical designs must have their value. The address of the firm is Germantown avenue and Second street, Philadelphia, and we know they will promptly respond to all inquiries.

TRANSACTIONS FOR JUNE OF THE AM. SOC. C. E.

This number contains the paper on "How Can Railways be made More Efficient in the Transportation of Freight?" read by the author, Mr. William P. Shinn, at the Annual Convention, held in St. Paul and Minneapolis, June 19. This paper is a summing up of the discussion on Mr. Shinn's previous paper on "The Increased Efficiency of Railways for the Transportation of Freight"; and in it he takes up and answers in order the views of the different gentlemen who have entered into the discussion.

In the "Proceedings" of this issue we have the official history of the late Convention, giving in full the different speeches made, and the general routine of business and pleasure followed by the members attending, a full list of whom is appended. The address of Director Wm. Metcalf, who appeared for the President of the Society at Minneapolis, is reported complete. One hundred and fifty members and 80 ladies took part in the doings of the Convention week.

A NEW SANITARY NEWSPAPER.—The second number of *Indoors and Outdoors* has made its appearance, It is the official organ of The National Association for Sanitary and Rural Improvement, and, as would be expected from its sponsors, in contents is devoted to the sanitation of towns and houses and to the general improvement of grounds about our homes. In appearance it is neat, and generally reflects credit upon the taste and judgment of its editors, Chas. F. Wingate, Sanitary Engineer, and also Secretary to the Association named, and John Y. Culyer, C. E. and Landscape Architect. The publication office is at No. 119 Pearl street, New York; the issue is monthly; price, 50 cts. per year.

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NOTICES OF MEETINGS.

AMERICAN INSTITUTE OF MINING ENGINEERS.

The Autumn meeting of the Institute will be held in Troy, N. Y., during the second week in October. This meeting will be mainly devoted to the reading and discussion of papers.

Members who wish their papers fully discussed at the meeting can have them printed and circulated in advance, if they are sent to the Secretary early in September.

THOMAS M. DROWN, Secretary.

R. W. HUNT, President, Troy, N. Y.

THE INTERIOR AFRICAN SEA.

At a meeting of the French Society of Civil Engineers held in Paris on July 19, M. Hanet severely criticised the proposed creation of an inland African Sea, and suggested that France had enough of other public works, of more utility, to engage in without entering into this gigantic scheme.

Among other remarks upon the subject, M. Hanet made the statement that the canal from Gabes to the Chotts Rharsa and Mel Ri would be about 124 miles long, and necessitate the removal of 800 million cubic yards of material; that the section of the canal, to provide the proper amount of water and the loss by evaporation, would be as follows: bottom width, 98 ft.; top width, 236 ft. in earth, and 121 ft. in rock; least depth of water, 36 ft. These dimensions would give a waterway equal in section to the River Seine. The evaporation he puts at 8,000,000,000 cubic yards per annum; and with the dimensions of canal given above, it would require ten years to fill the basin to the depth proposed over an area of about 3,000 square miles.

PHILADELPHIA WATER SUPPLY.

Chief Engineer Ludlow having asked from City Councils an appropriation of $2,000,000 for 1884, has been requested by the Controller to give the detail upon which he has based his estimates. This he does as follows:

For the maintenance of the department, including salaries, purchase of supplies, repairs to machinery, pipes and buildings, grounds and reservoirs, the purchase of pipe, laying of pipe and shop expenses, $624,000.

For a new pumping main from the Spring Garden Pumping Station to the Delaware Reservoir, $226,000; this is to utilize the two new engines now under contract for the Spring Garden Station.

For new distributing mains, $425,000. This includes the cost of seven distributing mains, from 16 to 30 in. diameter; intended to improve the water supply south of South street; the supply to West Philadelphia, which now depends practically upon one 20 in. main; between Sixth street and the Delaware River, where the largest present pipe is 10 in. in diameter; the district north of Susquehanna ave. and east of Sixth street, which has a single 10-in. supply main; and the continuation of the 30-in. main from the Schuylkill River to the Lehigh Reservoir.

For replacing old and worthless one, two and three inch pipe, $100,000. As far as is known the small distributing pipe less than six inches in diameter amounts as follows: One inch, 2,331 ft.; two inch, 6,317 ft.; three inch, 226,171 ft.; four inch, 583,417 ft.; making a total of 818,236 ft., nearly 155 miles of small pipe, some of which has been in the ground since 1817. Most of this pipe was laid at a time when the limited demand for water made them sufficient, especially when new and clean, to meet all the requirements of a distribution system. But with the advent of large manufacturing establishments, and other heavy consumers of water, this system of pipes has outlived its usefulness, and has become in fact an intolerable nuisance to consumers from its insufficiency. The amount asked for is estimated to relay with six inch pipe all the one and two inch pipe and about 40,000 ft. of the three inch pipe.

For continuation of work upon reservoirs, as follows: East Park Reservoir, $375,000; Cambria Reservoir, $150,000; Mount Airy Reservoir, $100,000; total, $625,000. These reservoirs are imperatively needed, and their completion and utilization cannot be reached too soon.

With regard to the receipts of the Department, the Chief says, that last year they were about $1,500,000, but by a re-inspection he expects to increase this revenue for next year. Water is now being charged for at meter rates, $1.00 per 1,000 cubic feet; he will recommend Councils to reduce this to 75 cts. per 1,000 cubic feet or 10 cts. per 1,000 gallons; this latter rate will yield a handsome income to the city.

STATE LINE SURVEY BETWEEN PENNSYLVANIA AND WEST VIRGINIA.

Mr. C. H. Sinclair, of the U. S. Coast and Geodatic Survey, has been relocating the line dividing the two States above named. In view of some very inaccurate statements which have appeared in some of the papers regarding this work, we give from an authoritative source the following data:

The meridian run from the last monument in the line between Ohio and Pennsylvania to Mason and Dixon's line, coincided within 4 inches with that of the first monument in the line between Pennsylvania and West Virginia, on the south side of the Ohio River, about a mile below Smith's Ferry, Pa.; this meridian was prolonged to the southern boundary of Pennsylvania, striking $54\frac{8}{10}$ ft. east of the southwest corner of Pennsylvania. The divergence from such old monuments as were found (located about 99 years ago) was at the rate of about 1 ft. per mile, excepting for the last 15 miles, where the divergence was proportionately greater. No monuments were found on the last 15 miles, and but 10 or 12 on the whole line.

The Commission appointed by the States had evidence that some of these monuments had been removed from their original location; and at the meeting held in Pittsburg, July 3 last, they agreed on a straight line from the monument on the north side of the Ohio River to the southwest corner of Pennsylvania; West Virginia losing in gross about five acres of area by this agreement.

The total length of the line between the Panhandle of West Virginia and Pennsylvania, that is the north and south line, is 63 miles and 4,454 ft., measured by triangulation. All the monuments in this line are now in position, and Mr. Sinclair is now establishing latitude stations on the east and west line, preparatory to its establishment.

The meridian run has been marked with four monuments as a line of reference, from which in case of removal of any monument restoration to its original place can be easily made.

The monuments used are sandstone cubes 15 in. square, placed 3 ft. 3 in. below the natural surface; above this is placed an index stone 12 in. square and 3 ft. long, of sandstone, leaving one foot of dressed stone appearing above the surface. On the north side of this stone is the date, "1883;" on the south side is the distance in miles and fractions of a mile from the southwest corner of Pennsylvania; on the west side the initials of West Virginia, and on the east side the initials of Pennsylvania.

The intermediate monuments, put in by Mr. Van Orden, of the Coast Survey, are placed upon the principal ridges, intersecting the line, and upon the most traveled roads.

The Commissioners on the part of Pennsylvania are Col. James Worrell, C.E.; James McCullough and W. W. Walker; and on the part of West Virginia, Col. Joseph C. Gist, John J. Chipley and F. L. Hoge, C.E.

THE INSTITUTION OF CIVIL ENGINEERS.

We make the following abstracts from the Annual Report of the Council for the year ending Dec. 19, 1882:

The Institution of Civil Engineers was established Jan. 2, 1818, and incorporated by Royal Charter on June 3, 1828; James Brunlees, F.R.S.E., is now the President, and Sir Jos. Wm. Bazalgette, C. B., Sir Frederick Bramwell, F.R.S., Edward Woods and George Barclay Bruce, the Vice-Presidents.

During the year 1882,238 candidates were elected and from various causes 90 names have disappeared from the roll; the present number of members, irrespective of students, is 3,385, made up as follows: 20 honorary members, 1,307 members, 1,536 associate members and 522 associates.

The House of the Institution was first occupied in November, 1868, when the total number of members was only 1,549, consequently the limit of accommodation in the present premises for the library and for the offices has now been reached; shelf room for books is especially needed.

The library now contains 18,302 volumes; of these 345 are volumes of tracts containing an average ot fifteen pamphlets each. The several publications are 349 in number. In 1850 this library contained only 3,300 volumes; the present increase is about 800 volumes per annum.

The Council refer with satisfaction to the financial condition of the Institution. The income for the year ending Dec. 30, 1882, was £12,898 10s. 11d.; while the capital and trust fund receipts amounted to £3,527 9s. 6d. and £431 15s. 6d. The general expenditure reached a total of £12,788 5s. 7d., including £1,500 used in the repair and decoration of the building, and £5,806 6s. 3d., the cost of producing four volumes of Minutes of Proceedings. The Institution has an invested capital of £39,833 11s. 8d. at par valuations, and trust funds to the nominal value of £14,642 13s. 10d.

The Institution has at its disposal four premiums—the Telford, Manby, Miller and Howard, to be awarded under especial rules to the authors of papers read at the meetings.

AMERICAN PORTLAND CEMENTS.

Any information about hydraulic cement, its properties, conditions of manufacture, etc., must be of interest to engineers, and under this head we reprint, in another column, some directions for making Portland cement, as deduced from the practice of that veteran manufacturer, D. O. Saylor, who, from an extended experience, should certainly know of what he writes.

From a little pamphlet issued by the same maker, we extract some further particulars relating to the history of Portland cements in America.

The cement known to the building world as "Portland cement" has been used in England and in Europe for from fifty to seventy-five years, but its introduction into America dates back scarcely fifteen years; in fact, it was little used until within the last ten years. In 1877 58,450 bbls. were entered at the port of New York; in 1882, to Oct. 1st only, the importation at the same port reached an aggregate of 269,565 bbls., or an estimated total for the whole year of 350,000 bbls., showing a most rapid increase in its consumption in the public and private works of this country.

The price to the consumer has fallen in proportion as the demand for it became greater; when first imported the price ranged from $7 to $9 per barrel, but in 1875 the price had dropped to $3.50 and $4 per barrel, and from the latest quotations, now ranges from $2.65 to $3.10 per barrel.

This increased demand soon attracted the attention of makers of cement in this country, and many experiments were made with native material, in the hope of manufacturing an article that could successfully compete on its merits with the English Portland cement.

In 1872 Mr. D. O. Saylor, then engaged in the manufacture of light-burnt American hydraulic cement in the Lehigh Valley, Penna., began the study of the subject, and erected a trial kiln; like

other experimenters he met with repeated obstacles, but in 1875, after many trials and failures, he was enabled to produce positively and regularly a uniform article of Portland cement, which has been the subject of many flattering testimonials from some of the most eminent of American engineers, who have used it extensively in the construction of public works. For the letter of these testimonials we must refer inquirers to the firm in question.

An analysis of this, now well-known brand of "Saylor's" Portland cement, results as follows:

ANALYSIS.

Silica	22.04
Alumina	10.11
Sesquioxide of iron	1.61
Sulphate of lime	1.78
Lime	62.93
Magnesia	1.13
Total	99 60
Weight, per barrel	400 lbs.
Weight, per bushel about	118 "

One barrel contains 3⅓ bushels cement.
One barrel cement measures 3 ft. 10 in. cubic measure.

This cement is manufactured by what in Europe is termed the dry process. The stone, as it comes from the quarry, is ground in steam crushers and mills into an impalpable powder. It is then thoroughly mixed in an iron mixer on its way to the pug mills, where it is tempered with water.

The product is then treated in a manner similar to the English method of making Portland cement, namely: it is spread out upon drying floors, and, when stiff, is cut up into blocks the size of bricks; these, when dry, are placed in the kilns wiih alternate layers of coke, and burned.

The clinker is then carefully selected, the pulverulent scorified, and the underburnt taken out; it is then ground and conveyed to the storerooms, the area of which is nineteen thousand square feet, where it is left a few weeks to sweat.

It remains in bulk in store until needed, and is then packed in barrels well lined with paper, to protect it from dampness—a provision especially needed in a damp climate.

In the "History of the Jetties at the Mouth of the Mississippi River," in which construction work some 12,275 bbls. of this brand of Portland cement were used, the following are given as the result of careful tests made upon about one-tenth of the above quantity.

Percentage of fineness, 88; average weight of struck bushel, 122; average tensile strength (one part cement, two parts sand), 102 lbs. per square inch; maximum, 133½ lbs.; average tensile strain, neat cement, 262½ lbs. per square inch; and the average of the maximum breaking strains of each lot of about 10 briquettes, 325½ lbs. per square inch.

The tensile strength in the above is from tests made seven days after mixing.

Wm. W. Maclay. Mem. Amer. Soc. C. E., in a paper upon the "Testing and Use of Portland Cement," made before the Amer. Soc. of Civil Engineers, November 7, 1877; has included this cement among his many tests, and gives as a result a tensile strength of 364 lbs. per square inch. for briquettes immersed in water one week; and 599 lbs. per square inch as the resulting tensile strength after ten months' immersion.

PERSONAL.

PROF. NICHOLLS, the new professor of civil engineering at Lawrence University, Kan., has arrived there.

CHESTER B. DAVIS, Hydraulic and Sanitary Engineer, of Chicago, Ill., is preparing plans for water-works for Eau Claire, Wis., and for sewerage, drainage and street grades for Marshalltown, Iowa.

BRINDLEY, the ablest and most original canal engineer the world has yet seen, was so illiterate that he could hardly write his own name; while GEORGE STEPHENSON, to whom we owe the greatest invention of the nineteenth century, could neither read nor write until he was 18 years old. Would early education have assisted or impeded the genius of these two remarkable men? It is probable that, whether trained or untrained in book-learning, Brindley and Stephenson would still have been great men.

C. C. SMITH, was re-appointed chief engineer of the St. Paul, Minneapolis & Manitoba, at a meeting held lately in St. Paul.

AN EDITORIAL VACATION.

THE HUDSON RIVER NIGHT BOATS.

"Four and one-half dollars to Saratoga and return" ran the small line of black-letter type that met our eyes every morning until "persistent advertising" won, as it always does, and we decided to again test the merits of the pure air and sparkling water of the celebrated resort. We found that the above sum covered a "stand-up" ticket for the round trip by the Troy line of steamboats. For $2 more we secured a stateroom, and having looked over part of the "page proofs" of the NEWS of the 11th, we got on board of the fine steamer City of Troy, and at 6 p. m. sharp were on the way up the beautiful Hudson. Every stateroom and berth was engaged, and there was quite an "overflow" who had to take "pot luck.' Among these were a number of the "Fresh Air Fund children," who were being taken to the country for a month, and who enjoyed themselves immensely on the lower deck, where they were given full license to play and romp to their hearts' content. In consequence of our late application for a stateroom, we found ourselves located immediately over and midway of one of the pair of engine boilers. The location was not pleasantly suggestive, nor was it conducive to sound and refreshing slumbers, such as are advertised as one of the attractions of the trip by water, as against the noise and dust by rail. Probably most of our readers have listened to the exasperating nasal music that is the nightly accompaniment of the railway sleeping car. Imagine then a steam snorer of several hundred H. P., which with every expiration shook your couch, so that you felt like being laid out on a vibrating shelf for the night; that is what a stateroom amidships means, and so we advise every intending tourist to save his dollars if he cannot secure one elsewhere, unless peradventure he is not troubled with such trifles as kept the writer awake until nature was exhausted and he got up, dressed and took to the upper deck and interested himself in the lighthouses that pointed out the narrow river near to Albany. A dense fog coming on at daylight there was nothing else to do but tie up at the first chance dock and wait till Old Sol cleared the way to go ahead. Nearly two hours were thus consumed, and then low water necessitated slow progress the rest of the way. The great steamboat actually would stir up the mud of the river, and we could plainly feel the sensation of the keel touching bottom. Certainly there needs to be some dredging done on the "American Rhine" near its upper steamboat navigation terminus.

SARATOGA HOTELS.

Saratoga probably has the *best* "summer resort" hotels in the world, without exception, and at the head of the list is the United States, although it is not easy to distinguish its superiority to the Grand Union. Both are immense caravansaries, capable of accommodating in the most luxuriant style as to food and lodging at one time fully 3,000 guests. The sanitation of great summer hotels is now becoming a subject of prominent importance, and the daily and class journals have had so much to say about it—in the past year especially—that proprietors and landlords are keenly alive to the advantages of pure and wholesome air and water throughout their establishments. At the States, water runs in abundance in all but the upper story; for some reason the pipes were not laid in that story, and hence the rooms are supplied with water in pitchers. The sewerage seemed perfect, and throughout Saratoga there is scarcely a complaint from sewer gas. A curious circumstance is that some years ago—and not very long ago, either—some hotels and houses discharged their sewage into crevices in the ground beneath them; the owners did not know where the sewage went to, and claimed there was no offensive results. But the village trustees objected after a time, and connections with the main sewers had to be made. Bethlehem, Pa., is another instance of this subterraneous, undeterminable disposal of sewage. We found there an entire house drainage turned into a crevice in the ground beneath, to go nobody knows where, and no offensive results being apparent.

GASKILL PUMPING ENGINES.

Saratoga is supplied with water for medicinal purposes by Nature's own energies; for domestic use and fire protection, the Holly Manufacturing Company, of Lockport, N. Y., have erected machinery. There has been a public water supply for about twelve years, the Holly Company putting in originally a pair of their quadruplex pumping engines, which, being found inadequate to the increased demands of the rapidly-growing popular resort, were supplemented quite recently by a pair of the Gaskill engines, now being manufactured by the Holly Company. As we had never seen one of these engines at work, and as the Saratoga engines have become quite noted on account of the severe duty tests to which they were subjected, so, of course, we paid them a visit of inspection. The pumping house is but a few minutes' drive from the center of the village, and over a very dusty road; the surroundings are not exactly in keeping with such a noted pleasure resort; and we do not think enough time, muscle and cotton waste are expended in "keeping up appearances" within the pumping house. The engines are massive and solid, and not much money seems to be expended on appeals to the eye by bright work.

The novelty of the design of the engines strikes one at first sight, and especially the short and direct method for transmission of the steam from the first to the second cylinder at each end. As we have already published a very complete description of these engines, by a celebrated expert, we have no occasion to enter into details here, but will refer to that description (see page 332 ante, ENGINEERING NEWS). The valves used in the pumps are peculiar to the Gaskill engine, and are covered by Gaskill's patent. They are independent in action and are of the same size for every pump, the number being more or less according to size of pump.

The tests of these engines have been very thorough. A first test by Messrs. D. M. Greene, of Troy, N. Y., and J. W. Hill, of Cincinnati, O., showed such excessive duty that it was discredited and another one was ordered by the Village Commissioners. This was conducted by Chas. T. Porter of this city, well known in connection with the Porter-Allen engine, and as an expert in steam engineering. We believe that no exceptions can be taken against the ability of these experts to conduct such a test, and we hardly believe any person will now be found rash enough to question their integrity. Questioning engineer Holland, in charge of the machinery, we learned how excessively particular they had been in conducting their tests; they took nothing for granted, and accepted no information at second hand. Mr. Porter's preliminary report we have already referred to, and his full report is now about ready, as we learned while in Saratoga.

In passing through the boiler room we noted the economy of fuel; only one boiler was fired up, and the grate surface in that had been reduced one-fifth. This economy is largely the result of an arrangement of Engineer Holland. An hour-glass-shaped contrivance is attached to the brick-work of each boiler; into and through this steam at boiler temperature is injected through a one-eighth-inch orifice to each boiler under the grate. The result is water-gas, which burns under the boiler, increases the heat and consumes all the smoke by its perfect combustion of the fuel. It is the invention of Engineer Holland, but is not patented. Probably Mr. Holland will communicate all the details to any inquirer. The mercury, which stood at 84° in the engine room, rose only to 90° in the boiler room.

The record of the engines is taken automatically by an Edson's Automatic Recording Gauge, and the sheets are filed away for reference after being translated into figures and recorded. From

the books of the engineer we transcribed the average record of the following weeks :

	Gallons pumped for the week.	Duty.
Ending June 30	13,545,620	91,799,629
" July 7	13,599,210	99,078,637
" " 14	13,969,740	94,009,701
" " 21	14,471,570	92,511,628
" " 28	15,226,520	92,914,144

The complete weekly official record ending with the day we visited the works, is given in the following table :

RECORDS OF SARATOGA GASKILL PUMPING ENGINE FOR WEEK ENDING SATURDAY, AUG. 11, 1883. DAVID L. HOLLAND, ENGINEER

	Rev. from 6 A. M. to 6 P. M.	Rev. from 6 P. M. to 6 A. M.	Total Revolutions.	Coal burned from 6 A. M. to 6 P. M.	Coal burned from 6 P. M. to 6 A. M.	Total coal.	Average water pressure.	Average steam pressure.	Average vacuum.	Gallons pumped in 24 hours.	Duty.	Remarks.
Sunday	6,220	4,300	10,530	2,400	1,600	4,000	100.2	70	26.0	2,011,220	90,641,431	Stopped a small leak in exhaust pipe.
Monday	6,850	4,800	11,650	2,400	2,400	4,800	98.6	70	26.0	2,225,190	87,677,041	
Tuesday	6,900	5,000	11,900	2,400	2,400	4,800	98.0	70	27.5	2,272,900	89,014,151	
Wednesday	8,000	5,720	13,720	2,400	2,400	4,800	92.7	70	27.5	2,620,920	97,774,746	
Thursday	7,970	6,150	14,120	2,400	2,400	4,800	89.2	70	27.5	2,695,010	101,917,460	
Friday	8,030	6,080	14,110	2,400	2,400	4,800	88.0	70	27.5	2,695,010	101,543,267	
Saturday	8,290	5,070	13,360	2,400	2,400	4,800	100.0	70	27.5	2,668,360	106,554,412	Coal brought in cart, 800 lbs. at a time, and charged at time when got.
Total and Average	52,270	37,720	89,060	16,800	16,000	32,800	98.1	70	27.07	17,188,090	98,488,878	

In all parts of the village we found abundance of water, and with sufficient pressure to supply several fountains on the highest ground; and we were assured that there could be no complaint on account of insufficiency of the domestic supply. With regard to the fire pressure we had no opportunity of personal observation. We *were* present at the little blaze and big smoke under the Grand Union Hotel on the 15th; the fire was in the basement of a small store, and all that was necessary was to get the hose into the basement and turn on the water. We do not know how high water can be thrown, but we understand that the present main is quite too small to deliver the water that the pumps will furnish in emergency.

SEWAGE DISPOSAL AND PAVEMENTS.

The disposal of its sewage is a question which must before long be solved by the village of Saratoga. At present a 3-ft. sewer, commencing at Congress Park and running alongside of Village Brook for about two miles, conveys the sewage out of the village limits, and dumps it into the brook, by which it meanders as in an open ditch for several miles into Lonely Lake, thence by a narrow stream to Saratoga Lake, and eventually into the Hudson. This open sewer crosses the principal pleasure-drives, and being sluggish in motion, not only is the sight offensive, but the deposited material, drying and putrefying under the sun's rays, creates such odors as are especially offensive to people who are in the neighborhood on pleasure intent, and who are extremely sensitive to everything that is offensive. It is now designed to dispose of the sewage by some process or other, and for this purpose a Commission has been created, which, with the aid of the Village Engineer, is ransacking the literature on the subject of sewage disposal, and endeavoring to get at some effective plan. A plan has been devised by the Engineer, and an estimate of cost submitted with the Commissioner's report, and it is quite probable that $50,000 may be expended within the coming two years on the sewerage of the village.

The streets of Saratoga are macadamized, with the exception of a short piece of cedar block pavement in front of the United States Hotel, leading direct to the railway depot, and which was laid down to help save the nerves of the guests in that noisy side of the house.

THE VILLAGE ENGINEER.

The Village Engineer of Saratoga is Mr. L. H. Cramer, who has, with the exception of two years, held the office for some twenty years, and has designed and superintended the construction of all the public improvements of Saratoga. Mr. Geo. E. Waring was consulting engineer for the present sewerage system of the village.

TROY.

Troy is distant one hour's railway travel from Saratoga, and during "the season" the two places are in almost hourly communication. Troy is an extensive manufacturing city, and its importance is increased as being at the head of steamboat navigation on the Hudson River. It is also an important railway center. It has extensive rolling mills, blast furnaces and iron foundries. It is the headquarters of the stove trade, and it supplies a goodly portion of the civilized world with shirts and shirt collars. It can show more neatly dressed, pretty working girls than all other American manufacturing towns together. It is the seat of Rensselaer Polytechnic Institute, from which the most eminent civil engineers and many of the most noted men of the times have graduated, and it has supplied more surveyors and engineers with "working tools" than probably any other single city in the world during the past thirty years.

LUDLOW VALVE CO.

Probably the largest plant devoted to the exclusive manufacture of valves and hydrants for water-works purposes—the Ludlow Valve Company—is located here, and we were much pleased with our visit to their extensive works at 938 River street. Mr. H. G. Ludlow, the President of the company, was absent on a tour of pleasure in Europe; but we were very courteously received by the gentlemanly Treasurer of the company and his assistant, Mr. J. H. Hawkins. The great shops were full of workmen engaged in the manufacture of valves of all sizes, from a couple of inches to four feet; business was in sympathy with the active construction and extension of water-works in progress this year, and the main difficulty was to keep up with the constant influx of new orders.

EDDY VALVE CO.

This activity in the manufacture of water-works machinery we found further illustrated at the works of the Eddy Valve Company in Waterford, a few miles from Troy. There also we found the shops crowded with workmen and noisy with the hum of machinery, turning out valves and hydrants especially. We caught the very busy Secretary Knickerbocker "on the wing," and had the pleasure of making his acquaintance while looking over the works. The order books of the company show a most satisfactory demand for their goods, and insure constant work for the large force of employés for many months to come.

W. & L. E. GURLEY.

Among the many results of the Centennial Exhibition at Philadelphia were the improvements in surveyors' and engineers' instruments and the methods of their manufacture. The Gurleys of Troy have always led the van in the wholesale manufacture of instruments for surveyors, especially of common compasses, which they turned out in large numbers even many years ago. In 1872 we went through their extensive shops and wondered where they could find a sale for so many instruments. We had the same feeling the other day as we passed from shop to shop, and with thoughts of the large products of the manufacturers in Philadelphia and other cities of the country, we may well surmise that the surveyors and engineers of this favored land are not all in enforced idleness. If the activity of the Gurley shops is an index, we must say that the profession finds itself very fully employed.

In a good sized but excessively quiet room on the first or street floor of the building, we were introduced to a very quiet and courteous gentleman, Mr. Edward W. Arms, a graduate of the Rensselaer Polytechnic Institute of the class of 1869, but who has spent all his business life in this establishment, and who now has full charge of the "Dividing Room." There were 13 dividing engines—8 for circles; 2 for right lines as scale, rules, etc.; 2 engraving, and 1 for figures. One new engine, to be "the best that skill and money could produce" was in process of construction. These tools were nearly all the invention and adaptation of the past three years, and in the saving of time and labor have many times repaid their cost, besides insuring greater accuracy and beauty of workmanship. One engine was especially novel; it cut both horizontal and vertical division lines as it proceeded. Nearly every machine was entirely automatic. Engraving the name on the instruments is done by the adaptation of the pantagraph. A workman is kept constantly employed on the manufacture of special tools to be used in the production of parts of instruments. We noted many novelties as we passed through the shops, which, if we had had the time we would have described, as the manufacture of such fine instruments as are in daily use by surveyors and engineers cannot fail to be of interest to the profession.

The wood used for instrument boxes at the Gurleys' is Mexican mahogany; it does not warp, and is not so hard or heavy as the Central American wood. Spanish cedar was tried, but failed on account of the exudation of gum when exposed to the hot rays of the sun.

OSGOOD & MAC NAUGHTEN.

In very handsome offices in Albany we found the good-looking junior member of the firm of Osgood & MacNaughten slightly incensed over the ignorant slurs upon American dredging plant put forward by the French writer in *Le Génie Civil*, but good natured also, as all Americans are who "have a good thing and know it," as the orders for their "goods" show our Albany friends to have.

After a night of "comfortable and refreshing sleep," per steamboat advertisement, we found ourself once more in the pleasant offices in the "building with the tall tower," after a very enjoyable week's vacation.

PROGRESS OF WORK ON THE PANAMA CANAL.

[From the Bulletin du Canal Interoceanique.]

The last reports received from the Isthmus give the progress of work up to the end of June.

Colon.—During the month 28,606 cu. yds. of material have been put into the *Terre-plein de Christophe-Colomb* from the excavations at Monkey Hill; this material is for a great part stone. The two permanent railways leading to the new storehouses in the terre-plein are finished; the work of rip-rapping the mole progresses; during the month 2,266 tons of stone from the quarry at Kenny's Bluff have been put into place. The dredges Nos. 1 and 2 have deepened to 16.4 ft. a basin near the railroad jetty, intended for the delivery of the floating material of the section to the general workshops; they have also continued to clear the entrance to the canal. These dredges raised in June 54,000 cu. yds. of material, of which 3,100 cu. yds. were deposited upon the terre-plein by means of the floating "transfer" No. 1, which was put into operation toward the end of the month, and discharges at least 933 cu. yds. per day.

Gatun.—On June 19 a new section was created at Gatun, and on the 21st the dredge commenced work upon the canal at the mouth of the Rio Gatuncillo. After some delay, due to the clayey nature of the soil, the dredge handled 900 cu. yds. per day.

Buhio-Soldado.—The work done in this section amounted to 9,000 cu. yds. The contractors who, on May 30, agreed to move about 1,900,000 cu. yds.

of earth, are progressing with their preparatory work, and the section labor is preparing to attack the bends in the Chagres, above and below Buhio-Soldado, with the dredgers Nos. 1 and 2, as soon as they are released at Colon, by the putting to work there of the large marine dredge.

Taberriella.—The clearing of wood and the taking the levels in this section continue, and is satisfactory when the season is considered. The surface in this whole section being uniformly a little below elevation 13, it is thought that after a clearing of the surface for about 7½ ft. in depth, and the work of excavators for 16½ to 19½ ft. more, that the canal trench can be finished by the dredge.

San Pablo.—During June, 1,600 cu. yds. were put into the approach to the line of the canal. To finish this road will require an embankment about 500 ft. long and 8.2 ft. high. The wood is cleared off between the bridge of Barbacoas and the line of the canal.

Gorgona.—In June 17,333 cu. yds. of excavation was done within the limits of the canal.

Gamboa.—The foot of the exterior slope of the *barrage* Gamboa is completely traced by the line of templets in place. The men on the Upper Chagres have opened three trenches at about elevation 70—two upon the right bank and one upon the left.

Obispo.—Besides other work in this section the Obispo River has been turned aside in three places. Of these, two are between sta's. kilometres 47 and 48, and one between sta's. 48 and 49. The total earthwork executed in the month was about 29,900 cu. yds.

Emperador.—The new railway depot is finished. Work done in month, 33,300 cu. yds.

Culebra.—This section has now upon it 135 cars, of which 25 were mounted during the month; the work-shop has been finished; about 9,000 cu. yds. of earth moved.

Paraiso.—In this section the line of canal is attacked at five different points, comprised between sta's. 57 and 60; 9,000 cu. yds. were moved in the month.

Notice has been telegraphed that, during July, the total cube of earthwork moved equaled about 227,000 cu. yds.

Notwithstanding the unfavorable weather, the greatest activity reigns on all the work; and, at the end of July, 11,000 men were engaged on the works, including those in the workshops and storehouses, and occupied in handling freight, etc.

SIR ROBERT RAWLINSON, C. B.

This eminent English engineer is to be knighted by the Queen for his many and untiring services in the interest of the improved sanitary condition of his country.

Mr. Rawlinson was born in Bristol, England, February 28, 1810, descended from an old Lancashire family. His father was a general builder and contractor, and wisely made his son serve a practical apprenticeship in each department of work connected with those trades; in this way he became an efficient bricklayer, mason and carpenter. At the age of twenty-one he entered the office of Mr. Jesse Hartley, the dock engineer of Liverpool and measurer of masonry, and in two years became Mr. Hartley's principal assistant. In 1836 he became resident engineer, under the late Robert Stephenson, in the deep and difficult cuttings near Blisworth, on the Northwestern Railway. On the opening of the line in 1840, as the London & Birmingham Railway, Mr. Rawlinson entered the service of the corporation of Liverpool as assistant surveyor, where he remained three years, and then, on the recommendation of Jesse Hartley, became engineer to the Bridgewater Canal Trust. In 1847 he completed, with some modifications of his own, the designs of Mr. Elmeg, the former architect, for the erection of St. George's Hall, in Liverpool.

About this time Mr. Rawlinson turned his attention to the improvement of the water supply of Liverpool, and prepared the details of a magnificent scheme of supply by gravitation from Bala Lake, which was not then adopted, however, on account of its cost; a modification of Mr. Rawlinson's scheme, namely, taking water from the River Severn, is now in progress.

In 1848 the Public Health Act was passed for the proper administration of sanitary matters in England and Wales, and on the recommendation of Mr. Edwin Chadwick, C.B., Chairman of the Commission, Mr. Rawlinson was appointed an inspector under the act. His first service was the complete reorganization of the sewerage, surface drainage, and water and gas supply of Dover.

During the Crimean war Mr. Rawlinson was one of the Commission appointed to improve the sanitary condition of the field hospitals. With his associates, Drs. Sutherland and Gavin, he suggested and carried out such a system of reform that the death rate, which in Feb., 1855, the date of appointment of the Commission, had been 420 per 1000 per annum, was reduced by June, 1856, to 2 per cent. These satisfactory results led to the founding of a permanent Army Sanitary Commission, which sat for the first time in 1860; on this Commission Mr. Rawlinson has always had a seat. As a result of the working of this Commission the death rate of the Indian army has been reduced from 60 per 1000 annually to less than 20.

During the cotton famine of 1865-66, Mr. Rawlinson designed and directed the carrying out of public works in 93 Lancashire towns, with the end of improving the condition of the impoverished cotton operatives. These works involved the expenditure of £1,650,000, and "it is worthy of note that the administration charges of Mr. Rawlinson on this sum were only 3s. 6d. per £100."

In 1865 and 1868 Mr. Rawlinson was Chairman of the Commission appointed to prevent "pollution of rivers." In 1876 he and Mr. Clare Sewell Read were made Commissioners to inquire into the merits of various methods of dealing with town sewage. It was at this time he drew up his "Suggestions" for the use of local surveyors and sanitary engineers.

In 1879 Mr. Rawlinson became Chairman of the Royal Sanitary Commission of Dublin; he was here associated with Dr. Xavier MacCabe, and these gentlemen have already put in operation a system of drainage, etc., that it is hoped will in a few years redeem this most healthily situated but worst sanitated city in the kingdom.

At present Mr. Rawlinson is a member of the Council of Civil Engineers, a Vice-President of the Society of Arts, and a Chief-Engineering Inspector for the Local Government Board.

KEEPING FIELD BOOKS.

CONNELLSVILLE, PA., Aug. 20, 1883.

EDITOR ENGINEERING NEWS:

I should be pleased to hear from some of your numerous readers in regard to their manner of keeping transit, level and record books. Nearly every engineer uses a different form peculiarly his own, and it certainly would be an advantage were the results of experience combined and a certain definite form arranged, and hereafter to be used by all engineers. As this seems to be an "age of uniformity," why not begin at the beginning, and thus gradually inaugurate reforms, and in this matter they are certainly much needed. Yours truly,

JAMES K. BARR.

OBITUARY.

MR. J. J. SHAMLEFFER, a contractor of Kansas City, died on Aug. 21.

WM. SCULLY, a contractor of Cincinnati, died suddenly on last Saturday.

MRS. THOMAS MACKIN, wife of one of the oldest contractors of Chicago, died recently.

MR. W. H. EVANS, a well-known Civil Engineer of Covington (Ky.), died at Meridian, Miss., Aug. 28.

JOHN A. BURNHAM, age 72, a prominent railroad man and capitalist of Boston, died at his summer residence in Stonington, Ct., Aug. 23, from heart disease.

CAPT. E. H. SZALLA, who was in charge of a United States surveying party making surveys of Bayou Plaquemine, died in Plaquemine, La., on the 28th ult.

DIED.—In Brooklyn on Friday, Aug. 24, STEPHEN DENISON ADAMS, Civ. Engineer. Mr. ADAMS was born in Albany, N. Y., June, 1843, and was educated at the Brooklyn Polytechnic Institute, and subsequently at the U. S. Naval School at Newport, R. I. He served in the war as lieutenant in the 13th Regiment, N. Y. Vol. Artillery, Gen. C. K. GRAHAM'S brigade, Department of N. Carolina and Va. Since the war he has been engaged in civil engineering work in various States, and in Mexico and Central America, where he contracted the disease of which he died. During the intervals of railroad work, he has been engaged for several years past, and at the time of his death, in the Bureau of Engineers, Board of City Works, Brooklyn, in examinations connected with the proposed extension of the water supply. He was noted for his warm-hearted, generous nature, and was a great favorite with all with whom he was brought into contact.

PERSONAL.

MR. CARGILL S. KNOTT, D. Sc., F. R. S. E., assistant to the Professor of Natural Philosophy in the University of Edinburgh, has been appointed to the professorship of the department of science in the University of Tokio, Japan.

C. W. DURHAM, inventor of Durham's House Drainage System, and President of the Durham House Drainage Company, 187 Broadway, this city, returned by the "City of Richmond" on the 30th ult., from England, where he has been very successful in introducing his excellent system of drainage.

THE Council of the Institution of Civil Engineers having been applied to by Her Majesty's Government to nominate an engineer to serve as juror in Class 42 of the Second Section—engineering and machinery, at the Amsterdam Exhibition—have selected Mr. ALEX. B. W. KENNEDY, M. Inst. C. E., Professor of Engineering and Mechanical Technology at University College, to perform that duty, and Mr. KENNEDY has consented to act.

ROBERT BRUCE BELL, of the well-known and much-respected firm of Messrs. Bell and Miller, civil engineers, Glasgow and London, and Past-President of the Institution of Engineers and Shipbuilders in Scotland, died at West Croydon, England, on the 13th ult. *Engineering* says: "The deceased was certainly one of the ablest civil engineers practicing in Glasgow during the past twenty years. His professional work was chiefly in connection with rivers, harbors and docks, both at home and abroad."

THE Institution of Civil Engineers will be officially represented at the opening ceremonies of the Northern Pacific Railway by one of its vice-presidents, Mr. GEORGE BARCLAY BRUCE—ROBERT STEPHENSON'S second pupil—who, after serving an apprenticeship of five years in the engine works at Newcastle-upon-Tyne, was transferred to railways under construction, became the resident engineer in charge of the large masonry viaduct at Berwick-on Tweed, then was on the East India Railway, next for four years occupied the position of chief engineer in India for the Madras Railway, where the works were carried out departmentally by the company's staff, and for about twenty-five years has been in practice in Westminster, during which time he has been Engineer-in-Chief of Railways in Southern India, in South America, in Prussia, and in New Zealand. Mr. BRUCE is the guest of the Northern Pacific Railway Company, from his acceptance of the invitation in England to his return thither after the opening of the railway.

BENJAMIN SILLIMAN CHURCH, the recently appointed Engineer of the New Aqueduct, was born April 7, 1836, at Angelica, Allegany County, New York. He is the eldest son of Mr. JOHN B. CHURCH and MARIA SILLIMAN, daughter of Professor BEN-

JAMIN SILLIMAN, Jun., and granddaughter of JONATHAN TRUMBULL, Washington's friend and comrade, and the original "Brother Jonathan." On his father's side Mr. CHURCH is descended from old Knickerbocker stock, such as the SCHUYLERS, VAN CORTLANDTS,. VAN RENSSELAERS, LIVINGSTONS, etc., while among his mother's ancestry was numbered one of the "goodly company" of the *Mayflower*.

Mr. CHURCH was graduated at Dartmouth College in 1856, and at once entered upon the profession of civil engineering. He was employed for a time on the New Haven Railroad, then in making the original topographical survey of Central Park, and later was appointed Topographical Engineer of the Hydrographic Survey of the Croton River and Basin. He was engaged, also, under General GEORGE S. GREENE, in the construction of the great reservoir in Central Park, and was afterward placed in charge of the Croton Aqueduct as resident engineer. This important position he held continuously up to the time of his recent appointment, excepting for a short period during the civil war, when in the army as a captain in the Twelfth New York Regiment, and as Topographical Engineer in the Army of the Potomac.

Mr. CHURCH's long and faithful service in connection with the Croton aqueduct and his familiarity with the entire system of the New York water supply peculiarly fit him for the new field of duty to which he has been called. It is worthy of note that Mr. CHURCH's great grandfather, JOHN B. CHURCH, was President of the Manhattan Company, the first water company of the city, and that his great great grandfather, Gen. PHILIP SCHUYLER, brought to this country and presented to the city the first plans for sewerage of New York.—*Harper's Weekly.*

ARTESIAN WELLS—STOPPAGES.

A correspondent of the Denver *Tribune* writes as follows: "In an article in your paper occurs this passage: 'The ignorant theory is that the water comes from an underground stream or lake, and that after it has once been struck it is practically inexhaustible. The latter theory is an utterly mistaken one.'

This suggests some questions which your correspondent would be pleased to be enlightened upon. The Santa Clara valley, California, is surrounded on the east and west by mountain ranges. The west range is much the highest and is heavily timbered with redwood and other kinds of wood. This range of mountains also has several streams flowing from it to the valley, all of which sink soon after leaving the foot hills. In the valley a large number of artesian wells have been dug for irrigating purposes. In fact the large production of berries from that valley is due to those wells, many of which were dug twenty-five to twenty-eight years ago.

What I have to state further about these wells can be verified by several residents of Denver, who were at the time residents of the Santa Clara valley. In 1856 or 1857 a well was dug some 300 feet deep on what was then known, I think, as the "Bevans farm," two miles north of the town of Santa Clara, four miles from the bay. A fine flow of water was obtained from a six or seven inch bore. After flowing for months without any interruption, without any apparent cause the flow became very small. Tools were put down in the well and the trouble developed. A wagon load or more of driftwood, which was of the same species as found on the mountains, with a number of cattlebones, were taken out, and the flow of water restored to the original amount. The well continued to flow for years afterward, and in all probability is still flowing again. It was a common occurrence for wells in that valley to discharge redwood chips, which could have come from no other place but the redwood forests, 20 miles in the mountains. Now, the question which puzzles my brain is, if the theory of porous sand is the true one, how did the wood, chips and bones come out of these wells? I might also mention the fact of several wells having caved below 250 to 400 feet to the surface which cost hundreds of dollars to repair.

I have also understood that water will not rise above its source except by artificial means. If so, what is it that forces the water above the surface from the porous rock? Is it not a fact that the porous rock theory has been jumped at by oil well men? Are there not just as many facts in favor of the subterranean lakes or streams as in the porous rock theery? We would be pleased to have some wiseacre enlighten us on the subject.

In conclusion, it may not be improper to state that your correspondent resided for years in Santa Clara valley at the time mentioned, and owned one of the largest wells in the valley, which caved in, as mentioned, and that we have not drawn on our imagination or repeated wild stories.

WINNIPEG'S AMBITION—A HUDSON'S BAY ROUTE.

One of the most prominent of the unreal shapes in Winnipeg's dream of future greatness is a railroad connecting that city with Hudson's Bay, and a line of steamers sailing thence to England. The scheme is a grand one, and looks well on paper, but there are difficulties in the way. The country between Winnipeg and Hudson's Bay is perhaps the roughest on the continent. It consists in part of bottomless muskegs, into which township after township of earth might be dumped without improving the foundation. Between the Winnipeg River and Hudson's Bay the principal features are rocks, upon which other rocks are piled, and others on them in the wildest confusion, and in such manner as to create charmingly romantic scenery and grand effects. But as a country through which to build a railroad it is most forbidding, and the cost of construction would be too enormous for ordinary mortals to contemplate. Even were the road built to Hudson's Bay, the difficulties in the way of the northern route to Europe are not overcome. People who have recently gone to Hudson's Bay to prospect the route have found that that considerable body of water is navigable, and that egress may be had through the straits, in midsummer; but that the entrance to the bay is sealed by ice during nine months of the year seems to be well authenticated, while during the remaining three months navigation is made so dangerous by floating bergs and boundless fields of ice from the north, that it is exceedingly doubtful if the route can be used with any degree of safety at the most favorable season of the year. There are many optimist Winnipeggers who make naught of these difficulties and who affect to believe thoroughly in the practicability of the Hudson's Bay route, and that an attempt will be made to carry the road through is not at all improbable; but it will require a very great deal of additional information of th e favorable variety to cause the doubting people outside of Winnipeg to concede the feasibility of the scheme.—*Minneapolis Tribune.*

THE HEIGHTS OF STEEPLES, TOWERS, ETC.

Every one who has had occasion to note the heights of architectural works as given in guide books, encyclopædias, and other authorities on the subject, must have been struck by the varying figures often given for the same structure. The discrepancy is probably due, in many cases, to confounding the *feet* of different countries, these being of slightly different length. The following, which appeared in the Cologne *Gazette* just before the completion of the cathedral in Cologne, is said to be based upon accurate measurements, and will be worth preserving for reference:

"The two towers of our cathedral are now the highest buildings on the earth: they exceed by 1.50 meter the tower of St. Nicholas Church in Hamburg, which is 144.20 meters high. When completed, they will measure 160 meters, reckoning from the pavement of the cathedral cloisters, or 157 meters reckoning from the floor of the church itself. The following are the heights of the most remarkable high buildings in the world; towers of Cologne Cathedral, 160 m., or 157 m. (524 ft. 11 in., or 515 ft. 1 in.); tower of St. Nicholas at Hamburg, 124.20 m. (473 ft. 1 in.); cupola of St. Peter's, Rome, 143 m. (469 ft. 2 in.); cathedral spire at Strasburg, 142 m. (465 ft. 11 in.); Pyramid of Cheops. 137 m. (449 ft. 5 in.); tower of St. Stephen's, in Vienna, 135.30 m. (443. 10 in.); tower of St. Martin's, at Landshut, 132.50 m. (434 ft. 8 in.); cathedral spire at Freiburg, 125 m. (410 ft. 1 in.); cathedral of Antwerp, 123.40 m. (404 ft. 10 in.); cathedral of Florence, 119 m. (390 ft. 5 in.); St. Paul's, London, 111.30 m. (365 ft. 1 in.); ridge tiles of Cologne Cathedral, 109.80 m. (360 ft. 3 in.); cathedral tower at Madgeburg, 103.60 m. (339 ft. 11 in.): tower of the new Votive Church at Vienna, 96 m. (314 ft. 11 in.); tower of the Rathhaus at Berlin, 88 m. (288 ft. 8 in.); towers of Notre Dame at Paris, 7[illegible] m. (282 ft. 11 in.)."

The above enumeration does not include the iron spire of the cathedral at Rouen in France, which has been completed within a few years, after standing for many years without its apex or finial. The statements as to its height vary somewhat; but all agree in making it a little higher than the Strasburg spire. Our Washington monument at the national capital is to be even higher than the Cologne spires, if it is ever finished. It will be observed that no American buildings are given in the list we have quoted.—*Popular Science News.*

PILE-DRIVING on the Ohio Valley road will be begun at once, as the pile-driving machinery has arrived at Bellaire. The engineers have staked the route for twelve miles below the city.

CONNECTING THE UPPER TENNESSEE AND THE MISSISSIPPI.

In accordance with a survey of South Forked Deer River not long since made by Captain Jack Harrison, United States Engineer, we are informed that "the valley of the South Fork reaches eastwardly to within ten miles of the Tennessee." This fact suggests the practicability and urgent importance of cutting a canal from the Tennessee to the Upper Forked Deer Valley, thereby uniting the Tennessee and the Mississippi rivers, as well as making the Forked Deer a bold and navigable stream. As an engineering enterprise it would be neither costly nor difficult of accomplishment to cut a canal ten or fifteen miles in length when such large returns would naturally follow. The distance between the Upper Tennessee and the Lower Mississippi would be shortened over one thousand miles, and the Forked Deer, connecting these great rivers, would be literally crowded with commerce. A limited information of the topography of the Upper Forked Deer and the distance to the Tennessee River leads us to believe there is only one big ridge that would seriously interfere with canalization, and that could be tunneled if it was thought cheaper and more feasible. In regard to the relative elevation of the Upper Forked Deer and the Tennessee nearest the valley of the Forked Deer, we are informed that the latter has a fall abundantly sufficient to bring the water out of the Tennessee like a mill tail, so if this be true there would be no difficulty on this score. Considered from every standpoint, as far as we have investigated, the scheme is a feasible one, and government or corporation aid could be secured to carry it through successfully. The writer, however, is now consulting with a competent and skillful engineer, and hopes to be able to more fully explain the practicability of the enterprise in the next issue.—*West Tennessee Whig.*

A NEW EXPLOSIVE.

Lieut. Col. James M. Whittemore, of the Ordnance Department, has presented a report to the Chief of Ordnance on the "Climax self-ejecting, long range, non-heating cartridge" of Mr. Edwin Gomez. As to the peculiar mode of the construction of his cartridge he says:

"The mechanical part of the invention as presented consists of the ordinary elongated bullet, to which is attached a wooden cylinder for the reception of the explosive. This cylinder is 2¼ in. long, is pierced perpendicular to its axis, with 5 holes, each of a diameter of .25 in. A small axial hole, .01 in. in diameter, finds place. This hole and the holes bored diametrically receive the powder or paste, a coating of grease protecting the composition. The ingredients of the explosive are unknown, the inventor not desiring to communicate this information." As to the trial, Col. Whittemore says:

"The cartridges were used in an old model Sharps breech-loading percussion cap rifle. The inventor has confined his ideas of the trial almost solely to the effect of the explosive, leaving other details, such as the application of it to our modern systems of gas check primed metallic cartridges used in modern arms, a subject for future development. He claims less heating of the gun in continuous firing –a minimum of recoil—less fouling than gunpowder and greater penetration than given by the latter for the same weight of his explosive, and that he can make it a primed cartridge; also (as used now) that no necessity for extraction exists, as the wooden cylinder is ejected with the bullet. The trials were necessarily confined from our limited resources here to firing a few rounds for penetration at short ranges, and also to observe the action of the gases upon the bore as far as fouling is concerned, etc.

"The charges varied from 43 grains up to 70 grains. In comparison with the latter charge the Springfield breech-loading rifle was fired. In this case the penetration was 15 one-inch boards, and in the case of the Springfield 11 one-inch boards. In his case his gun broke, which leads to the inquiry if an increase did not attain in his case over the ordinary pressures in the Springfield rifle.

"His explosive apparently fouls the gun less than ordinary gunpowder, but the experiments were too limited to establish this point. In the use of 43 grains (the normal charge of his gun) he obtained in five shots an average of 7¼ one-inch boards penetration.

"The experiments made were too meagre and crude to arrive at any definite conclusions as to the merits of his inventions. The subject of introduction of a new explosive for small arms to supersede ordinary powder is so broad a one as not to be even preliminarily approached by such means as are at the command of Mr. Gomez, and if it is desired to make any tests in this direction it stands to reason that trials looking to even a broad prospecting of the subject can only be made at a place where some facilities are available to prosecute experiments. This leads me to remark that if the

subject is deemed of sufficient importance, that further preliminary experiments with Mr. Gomez's powder should be made at the Frankford arsenal.

"A few tests made recording velocities, pressures, etc., would give a dawn of light which would enable the experimenter to form a judgment as to whether or not additional and more costly ones should be inaugurated."

NEWS OF THE WEEK.

THE FORTH BRIDGE RAILWAY.—Major-General Hutchinson and Major Marindin have reported to the Board of Trade upon an inspection which they made of the works in progress for the construction of the bridge over the river Forth at Queensferry. After giving details of the progress made with the excavation of the foundations of the viaduct piers, which are on Whinstone rock, the inspectors say: "The engineers have furnished us with diagrams of the strains upon the piers and other parts of the bridge, showing that, according to the result of their calculations, under no possible combination of a 56-lb. wind blowing in any direction, and a rolling load of 3,400 tons on the span (*i. e.* two tons to the foot), will the stress, either in tension or compression, exceed one-fourth of the ultimate resistance of the steel to be used in the construction of the bridge, viz., 30 tons per square inch in tension, and 34 tons in compression. We can report that the preparations which have been made, and the machinery and plant which we are informed have been ordered, indicate that it is the intention of the engineers and contractors to carry out the work in a manner suitable to the magnitude of the undertaking, and that, so far, these works have been completed in accordance with the authorized plans, and in a satisfactory manner.

THE KANSAS CITY ENGINEERS' ASSOCIATION met Aug. 25, at 509 Delaware street, with Mr. John Donnelly as chairman and Mr. B. Hottelman as secretary. Messrs. Holmes, Bontecou, Knight, Neir, Pearsons, Daniel O'Flaherty, Farnsworth, Knickerbocker and Keoller were present. The new members elected were as follows: J. J. Burlingame, H. A. Baker, E. O'Flaharty, F. H. Crosby, Walter Hale, T. C. Lea and W. W. Jameson. A committee on selecting new and permanent quarters was appointed as follows: Messrs. Knight, Knickerbocker and Holmes. After adjournment a very pleasant informal discussion took place. The next meeting will be in the evening of the last Saturday in September.

R. R. CONTRACTS.—Chief Engineer Bell, of the Souris & Rocky Mountain Railway, is busy subletting contracts for the construction of this road. It is reported on pretty good authority from British Columbia that Mr. Dunsmuir had signed the contract to construct the Vancouver Island Railway in consideration of the land subsidy and a cash bonus of $750,000, and that surveys will be commenced immediately and the entire line placed in running order by the fall of 1886. Mr. Cameron, railway contractor from the United States, has arrived at Port Arthur, in order to take an interest in the construction of a portion of the Lake Superior Section of the Canadian Pacific Railway.

A CARLOAD.—Nominally, a carload is 20,000 pounds. It is also 70 barrels of salt, 70 of lime, 90 of flour, 60 of whisky, 200 sacks of flour, 6 cords of soft wood, 18 to 20 head of cattle, 50 or 60 head of hogs, 90 to 100 head of sheep, 9,000 feet solid boards, 17,000 feet of siding, 13,000 feet of flooring, 40,000 shingles, one-half less of lumber, one-tenth less of joist, scantling and other large timbers, 340 bushels of wheat, 400 of barley, 400 of corn, 680 of oats, 300 of flaxseed, 366 of apples, 340 of Irish potatoes, 360 of sweet potatoes, and 1,000 of bran.

PRESCOTT (Arizona) is to have a railroad. The engineer corps has arrived at Ash Fork, and will immediately commence the work of surveying and locating the road. Mr. McCormack expects to start an additional force of men at work some time next week.

RAILROADS WANTED FOR GEORGIA.—If we are to believe a Savannah paper, many more roads are required. It says: "A State with an area of 59,000 square miles, according to the latest and most accurate survey, and only having 2,300 miles of railroads, is only half developed. Georgia has land enough to support 5,000,000 of people with ease and at the same time to raise productions for export. But we should have in the State no less than 4,000 miles of railroad to properly develop our great and growing resources. We want all the roads to look toward the seacoast, and especially toward Savannah, if we are ever to have direct trade with Europe. Let us look at the map of the State and see what could be done. 1. We should have a road from Louisville through Sparta to Union Point, thence to Athens, and thence in an air line to Chattanooga; if not to Chattanooga to Knoxville, Tenn. That would open a new country for Savannah, and one of unsurpassed advantages. 2. We should have a road direct to Americus, and thence to Columbus. 3. The gap between Eatonton and Madison should be built. 4. A road from some point on the Central to Swainsboro, and thence to Dublin and thence to Eastman, should be built. 5. There are a number of local roads that should be built, which would give a number of growing towns an easy and quick market, which are now cut off for the want of railroads. Main trunks should hold out encouragements to such enterprises. The State is growing, and it is natural that small corporations should look to large and rich ones for aid and encouragement."

DEPARTMENT OF PUBLIC DOCKS.—The Dock Commissioners held their regular weekly meeting on the 29th. Estimates for furnishing necessary labor and material for building a new pier at the foot of West Twenty-ninth street, North River, to be known as pier 59, North River, were considered, when the following bids were filed:

John Gilles, $28,779; James D. Leary, $33,994; Joseph Walsh, $33,800; M. P. Kelly, $30,500; Seaford Ross, $36,500.

Estimates were also considered for repairing pier at the foot of Eighty-sixth street, East River, and for building a new pier at the south side of Eighty-sixth street, East River, when the following bids were filed:

	Repairs to pier.	Est. cost new pier.
John Gilles	$4,768	$4,677
Flaherty & Cornell	6,500	6,700
M. H. Wood	5,750	5,750
James D. Leary	5,690	4,240
Joseph Walsh	5,000	5,000
M. P. Kelly	7,000	6,000

The several bids, with the names of the sureties offered, were forwarded to Comptroller Grant for his approval.

A NEW-MEXICAN ROAD.—The Albuquerque, Copper City & Colorado Narrow Gauge Railroad has been incorporated. The principal office will be at Albuquerque, N. M. The charter calls for a line from Albuquerque to Copper City, distant about ninety miles, and thence to Chama, in Colorado, where connection will be made with the Denver & Rio Grande Railway.

THE IRRIGATING CANALS OF COLORADO have been finally surveyed by Mr. W. H. Graves, the chief engineer of the company that is to construct them.

ADAMASCOBITE is the local name of a mineral which is said to be found in only one place in the world, and that is the State of Missouri. The stone is very peculiar in its structure and properties. Its cutting power is diamond like, cutting away steel very rapidly, and still retaining an exceedingly fine edge.

NO END OF BRIDGE GATES.—It having been published in some Indiana paper that the City of Chicago would give $10,000 to the person furnishing the best model of a bridge guard-gate, nearly all of the male population of the State has turned its attention toward inventions. In the meantime Chicago genius is not idle, and all sorts of bridge models are coming into Commissioner Cregier's office.

OCONTO (WIS.) WATER-WORKS.—Articles of association were filed with the Secretary of State at Madison of the Oconto Water-Works Company, whose capital stock is $5,000.

CONNELLSVILLE (PA.) WATER-WORKS.—The construction of these works was commenced on May 12 last, and is now practically completed. The supply is by gravity. The reservoir is 75 ft. above the highest part of the town, and 280 ft. above the lowest where water is taken. The sizes of pipe used are 10, 8, 6 and 4 in. diameter. There are six miles of pipe and 57 double-delivery hydrants. Cost of miles, $50,000. The engineers in charge of construction were Messrs. Adam Miller and C. W. Knight, who are also building the Uniontown, Pa., works. The Water-Works Company is composed of James S. and W. S. Kuhn, A. M. Spear, J. H. Scott and D. C. Huffman, all of McKeesport, Pa. James S. Kuhn is president and W. S. Kuhn is secretary and treasurer. The water rates are: For dwelling-houses, for single faucet, $5.40 per year, and for each additional faucet $2.25; bath tubs, $3.60. The rates vary somewhat for boarding-houses, hotels, stores, offices, stables and other purposes.

NORFOLK & WESTERN R. R.—The increase of earnings of July 1882 over July 1883 was $12,230, or 14.5 per cent., and the increase for the seven months of 1883 ending July 31, over corresponding period last year is $109,706, or 22.5 per cent.

THE INDIANAPOLIS BRIDGE CO. have increased their capital stock from $25,000 to $75,000, their business having increased to such an extent that larger facilities and more capital was required.

AN INTERNATIONAL EXPOSITION AT NICE, Italy, is to be held, open from Dec. 1, 1883, to May 1, 1884. It is to be under the patronage of the City of Nice, the State, the Department of the Maritime-Alps, and the Chamber of Commerce of Nice; and will comprise in its exhibits all that relate to agriculture, manufactures and the fine arts.

THE PEORIA & FARMINGTON RAILWAY, which was commenced as a narrow gauge, has been changed to a standard gauge, and has been completed to Keithburg, on the Mississippi River, a distance of 92 miles from Peoria, Ill.; it is now open for business and is known as the Illinois Division of the Central Iowa Railway. To connect the Iowa lines of the C. I. Railway with this division, the Mercer County Bridge Co., of which John F. Wallace is chief engineer, has under construction a transfer, which will be in operation by Sept. 10. The Bridge Co. expects to have a first-class iron bridge completed over the Mississippi River at this point by Jan. 1, 1885.

BATES & HEAN, of Chicago, have completed the suction main and inlet at Duluth, Minn., and the work has been accepted and paid for. There was a large amount of submerged rock work (granite) done. At the end of the main is one of Hean's patent inlets of three cages, to provide security against anchor ice.

THE INSTITUTE OF ARCHITECTS.—The seventeenth annual convention of the American Institute of Architects began at Providence, R. I., Aug. 29. Twenty-five or thirty members were present from various parts of the country. Thomas U. Walter, LL. D., of Philadelphia, the oldest member of the Institute, presided. In his annual address Mr. Walter recommended that an effort be made to realize the national character of the organization by bringing into professional relationship all architects in good standing throughout the country, and favored easy terms of admission. The report of the trustees showed that eight associates had been added during the year and one associate, three honorary members, including Peter Cooper, and two corresponding members had died.

The secretary of foreign correspondence reported a correspondence regarding an understanding with the convention of French architects, looking to an international agreement among architects on terms of architectural competition, and suggesting that a committee be appointed to represent the Institute.

Reports from the Providence, Boston, New York, Chicago and San Francisco Chapters of the work during the year were presented. They indicated a growth in membership and general progress. The report of the treasurer showed the cash on hand to be $467.

Messrs. Nickerson, McLaughlin and Kendall were appointed a committee on nominations. The by-laws were amended by removing the limit of seventy fellows to constitute the Institute, that limit having already been reached. The number of fellows necessary to constitute a chapter was also reduced, so that the formation of other chapters might be facilitated.

EFFECTS OF BAD WATER.—PORTSMOUTH, N. H., Aug. 26.—A careful investigation indicates that the malarial fever existing at Little Boar's Head, Rye Beach, and the vicinty is traceable directly to the tainted water of a well adjacent to the cottage occupied by Mr. Lewis, who died recently. The well was sunk near the base of a hill, while a cesspool for the reception of refuse was located higher up the same hill. The well water is now very offensive. Two summer residents have already died and another is not expected to live.

FIRST THROUGH FREIGHT OVER N. P. R. R.—The first car of through freight consigned to Portland, Ore., was sent Aug. 24, from Milwaukee via the Northwestern. It was a car-load of beer.

THE MINNEAPOLIS, SAULT STE. MARIE & ATLANTIC R. R. was incorporated at St. Paul on the 16th ult. Capital, $1,200,000. The first board of directors consists of W. D. Washburn, Thos. Lowry, H. T. Welles, Clinton Morrison, J. K. Sidle, G. R. Newell, C. M. Loring, C. A. Pillsbury, U. C. Rand, W. W. Eastman, Anthony Kelly, and H. G. Harrison. Gen. Washburn was interviewed at Minneapolis the other day, and gave a reporter some statistics regarding the above enterprise. The company was organized to build a railroad from Minneapolis and St. Paul to Sault Ste. Marie. The people to be beneficially affected by its construction have concluded that the time has arrived for a step intended to protect the commercial and business interests of both Minneapolis and St. Paul, and this new company has been organized with that full determination. The entire distance from Minneapolis to Sault Ste. Marie is 455 miles, and of this 125 miles are now traversed by a railroad, built or under contract, from the Sault in this direction, and the new company proposes to fill the remaining gap. The Canadian Pacific Company is extending its lines westward from Montreal and Brockville via Lake Nipissing to Sault Ste. Marie, a distance of about 150 miles only—the road having been completed to the lake mentioned. The connection with the Canadian Pacific (with our new road and the gaps completed), the distance from Minneapolis to Montreal is but the same as from Chicago to New York. For two-thirds of the year, two-thirds of the shipments would go by rail to Montreal. The new line will necessarily take all New England business from the Northwest, from the fact that the line from Minneapolis to Port-

land, Me., is 330 miles shorter via Sault Ste. Marie than via Chicago, and 200 miles to Boston by the same route. The time from Minneapolis to all New England points will be twelve hours less than via Chicago, and the distance from Minneapolis to New York is 100 miles less by the Sault Ste. Marie line. With this new road in operation sleeping coaches will be run from Minneapolis and St. Paul to Boston without change. It will traverse and make tributary an immense belt of pine and hard wood for manufacturing purposes, and assist immeasurably in opening the, as yet, undeveloped iron ranges of Northern Wisconsin. We will send two engineering parties into the field at the earliest moment possible; the preliminary survey will be made as early as the 1st of January next, and the line will be permanently located so as to warrant a commencement of work early in the spring.

A ROAD FROM LA CROSSE (Iowa) to St. Joseph (Mo.) is talked of. The road is partially surveyed and some right of way granted. The road will be 425 miles long, and 380 of this will traverse Iowa. It is thought this is a move of the Canada Pacific to secure an inroad to the great coal lands of the Southwest. The capital stock is $20,000,000.

A RAILROAD TO PIKE'S PEAK (Col.) is under discussion. City Engineer W. F. Ellis, of Colorado Springs, has surveyed the route and given a report. The distance is thirty miles. It would be higher than any other railroad in the world. It has been called the "Tangent Line." So crooked is the surveyed route, that for a distance of twelve miles there will not be 600 feet of straight road at any one place. The average grade is set down at 300 feet to the mile, which will eclipse every other road in the world of a corresponding length in grade.

METAL WORK FOR LIGHT-HOUSES.—Schedule of proposals for the metal work of Cape San Blas and Sanibel Island light-houses and keepers' dwellings, opened at the office of the Light-House Board, August 15, 1883, at 2 o'clock P. M.:

Name of bidder.	Cape San Blas light-house.	Cape San Blas keepers' dwelling.	Sanibel light-house and keepers' dwelling.
Phœnix Iron Company, Trenton	$8,750.00	$3,750.00	$12,500.00
Cooper Manufacturing Company, Mount Vernon, Ohio	9,880.00	3,104.00	13,300.00
George C. Noyes, Georgetown D. C.	11,200.00	3,500.00	14,314.53
West Point Foundry Association, Cold Spring, N. Y.	14,580.00	2,460.00	17,040.00
Pusey & Jones Co., Wilmington, Del.	*17,170.00		*17,170.00
Joseph M. Duclos, New York City	14,400.00	2,980.00	17,380.00
Jonson Foundry and Machine Company	22,000.00	1,975.00	23,975.00

* Light-house and keeper's dwelling inclusive.

Ordered, That the proposal of the Phœnix Iron Company, in the total sum of $25,000, be accepted, and that a contract in accordance therewith be approved.

DEATH OF THE FATHER OF THE TUBE TRADE.—It is with regret we have to report that Mr. Cornelius Whitehouse, the original patentee of wrought-iron gas tubes (the manufacture of which is now one of the staple trades of Wednesbury), died on Tuesday, the 9th inst., in the eighty-ninth year of his age. We may mention that the bulk of the tubes, as now made, are still being manufactured in the manner described in Mr. Whitehouse's patent taken out in 1847, the year he commenced business as Whitehouse and Co., at the Globe Tube Works, Wednesbury, whose trade-mark of the "Globe" became one of the best known for tubes in England and abroad. It is with much sorrow that we have to record that in common with most other patentees the benefits Mr. Whitehouse conferred on all countries through his invention did not leave his latter days with such substantial means as, from the importance of the industry he created, one could have wished him to be in the enjoyment of. As may be remembered we reported last year that these works, good will and trade-mark, had been acquired by Mr. John Spencer, and are now in full operation.—*Engineering.*

DANVILLE, LAPORTE & BERENICE R. R.—A corps of engineers, in charge of O. H. Ostrander, C. E., are now making a survey for a railway line between Danville, Pa., and Laporte. This movement is backed up by manufacturers and capitalists who are satisfied that the road, when built, will do a large business in the transportation of coal, iron ore and lumber, and will form the shortest and best route between the Philadelphia & Reading and Pennsylvania Railroad systems in Pennsylvania, and New York, Lake Erie & Western and Hudson River & New York Central Railroad systems in New York. The proposed route has been advocated for many years, and it is believed a strong syndicate has been formed with a view to construct the road at once. Valuable fields of the best known steam coal exist at Berenice, in Sullivan County, Pa., the northern terminal of the line. The road will be 45 miles long, and will cost to construct $1,200,000.

TWO SURVEYING PARTIES are to be sent by the Minneapolis, Sault Ste. Marie and Atlantic road to lay out a route between Minneapolis and Florence, on the N. E. boundary of Wisconsin.

MORE MEXICAN ROADS.—Several railroad men passed through St. Louis a few days ago en route for Gonzales City. The party was in charge of Mr. Burr Shields, civil engineer, and comprises Messrs. W. D. Buckner, H. P. Allen, R. J. Meigs, Matthew Brooks and Wm. Wansleben, of Washington and New York. Also accompanying were Col. Owen, civil engineer, and Col. W. K. Rogers, formerly private secretary to ex-President Hayes. Most of the expedition, numbering over thirty, are already in Mexico, the preliminary survey of the enterprise, the Mexican & Pacific Railway, having been made some time ago. This road runs from Fernandina, on the Atlantic coast of Florida, near the Georgia line, to Topolobampo Harbor, on the Gulf of California.

THE Federal Building at Leavenworth (Kan.) has not yet been located. Only $10,000 has been given for the purchase of a site. It is not probable that the building will be begun for some years.

A MISSING contractor is reported to be Capt. John Hall, of New Brunswick, N. J. He had the contracts for laying the third and fourth tracks from Holmesburg to New Brunswick on the Pennsylvania Railroad.

A LARGE sum for one month's work ($104,800) was lately paid Messrs. Buson & Hammond, the contractors for the Canton, Aberdeen & Nashville branch of the Illinois Central Road.

THE SANTA FE RAILROAD.—Mr. Lake, the locating engineer of this road, was lately in Socorro, N. M. The survey from Alamillo is not yet completed; the surveyors are fifteen miles from the Magdalenas. Mr. Lake says that these surveys run to a point on the edge of the San Augustine plains, about forty miles from Socorro. Both meet at the north end of the Magdalenas, so that the distance of the routes from Socorro and Alamillo is about the same. The grade from Alamillo is easier, but there is a winding box canyon, about one mile and a half long, near there, that will be a difficult passage.

THE SEVERN TUNNEL.—At the half-yearly meeting of the Great Western Railway Company, Sir D. Gooch stated in answer to Sir Charles Whetham, that the Severn Tunnel would take two years to complete, and would cost $7,350,000. The length of the tunnel would be 4½ miles.

THE FLORIDA SHIP CANAL.—*To the Editor of the Sun—Sir:* In this morning's SUN is printed a notice of a meeting of the incorporators of the Florida Ship Canal Company. The papers seem to treat this project seriously, and it is about time to let the public know that the scheme is wild and utterly impracticable.

First—It would cost five times as much money as any estimate made by the engineers, or about $250,000,000.

Second—It would require more time to go through the canal than to keep the open sea.

Third—The insurance would be higher by one-half of 1 per cent., the making of two ports adding to the risk.

Fourth—It would be quarantined half of the time.

Fifth—No shipmaster would be foolish enough to patronize the canal if it was open.

These ideas may seem original and absurd, but any honest man who desires to satisfy himself can consult any shipmaster or underwriters' agency in the city of New York or elsewhere, and he will find that I am right, and that my conclusions have been formed after a thorough investigation of the subject.

It would not materially shorten the distance for any vessels except those plying from our Gulf ports coastwise. All foreign vessels would prefer Cape Florida or the Windward passage.

The dangers of the Florida Reefs are fearfully overestimated on account of the vast number of vessels intentionally run on the reefs by dishonest captains or owners to get insurance and a "divy" of the salvage. That is a thing of the past.

The danger of lying in the bight of Florida near the Gulf end of the proposed canal is much greater than in the most treacherous piece of water on all our coasts.

Foreign vessels would have to enter and clear at each end of the canal, pay towage in, towage out, towage through, port dues, pilotage, hospital dues, tonnage, toll, run the chance of quarantine, and have all dutiable goods under supervision of a customs inspector all the way through, while the officers would be compelled to stand over the crew with handspikes to keep them from deserting. While it would be but 300 miles further to go around, it would take several days longer to go through the canal, including lying outside for weather to come in, and all delays incident to making two ports. There is a vast difference between canals across the grand Isthmus of Panama and Suez, where 10,000 miles of sailing is saved, and one across the peninsula of Florida, where only from 300 to 500 miles could be saved. There is four times as much traffic around the peninsulas of Malacca, Denmark or Spain, but no ship canal exists at any of these points.

JOHN A. MACDONALD, C. E.

EUSTIS, Fla., Aug. 20.

NEW VIADUCTS.—Commissioner of Public Works Cregier, of Chicago, had a conference on the 25th with Manager Hewitt, of the Chicago & Northwestern Railway Company, in regard to the construction of viaducts at Chicago avenue and Halsted street and Centre avenue. The company agrees to pay for the erection of the superstructures. As soon as the officers of the Chicago, Burlington & Quincy Railroad return to the city they will also be consulted as to the construction of the Centre avenue viaduct, and there is no doubt they will agree to pay their portion. The Chicago avenue viaduct will cost about $225,000 and the Centre avenue viaduct $75,000, the city's portion being about one-half. The Department of Public Works will advertise for bids as soon as the Chicago, Burlington & Quincy agree to the terms.

THE ELECTRIC LIGHT craze in London resulted in the formation of a large number of companies, many of which are drifting into bankruptcy. The mania has completely fizzled, and investors have lost heavily and are complaining bitterly about alleged misrepresentations. The fever was worked up from this side of the water, and does not help to strengthen confidence in American enterprises.

IRON AND METAL MARKETS.

PHILADELPHIA, AUG. 30.

The lull in the iron trade holds on, even in the face of some attractive concessions, especially in some inferior grades of crude iron. There is a show of firmness in all the standards and specials, but where buyers are in earnest they can get iron at a shading of from 25 to 50 cents per ton. No large transactions have been closed, though several are under way. Foundry ranges from $22 @$23 for the good brands; 50c. to $1.50 less for common. No. 2, $19@$20; average, $20. Forge, $18.50@$20; average, $19.25@$19.50. Nothing has been done in Speigeleisen or Bessemer. Merchant iron is dull at 2.20@2.15c. Nails, $2.90@$3. Plate and tank iron firm at 2.40@2.50c. Structural iron is under active inquiry in 50 to 200 ton lots. Beam and channels, 3½c.; angles, 2.40c. Steel rails quiet at $38; crop ends, $23@$25; tees, $23@$23.50; double heads, $25@$25.50. Scrap, $23@$25, according to quality. Mills are increasing output of finished iron, and furnace production is fully up to all requirements. Heavy buying will be done in September.

Large offerings of foreign rails are made through brokers, notwithstanding rumors of scarcity abroad. Spikes, 2.60c.; splice bars, 1.90c. Merchant steel is in improving request, though prices continue low. Crop ends, $24.50. Scrap dull. Activity is predicted with confidence early in September. Several large requirements have been withheld, especially for crude iron and railway material.

CHICAGO.

Improving inquiry is telegraphed from several important Western iron centers. The trade is in good shape, although current business is light. Prospects excellent, but buyers will not anticipate requirements. Since last week a half-dozen Western rolling-mills have resumed operations. Prices are weak, but an upward tendency is probable in merchant steel, finished iron and rails. Furnace output is increasing. Ore is weak; output one-half million tons between same time last year.

PITTSBURGH.

There has been a slight falling off in the demand for crude iron, but no corresponding weakness in prices has been developed. The near-by furnaces are well sold up, but outside furnaces are making concessions to move large blocks without much success. Consumption is increasing with the general resumption of operations in the rolling-mills. Forge ranges from $17.50@$18, Foundry, $18@$20; Charcoal, $24@$26; Muck Bars, $33.75@$34. Cutting on present low prices is going on. Trade is not up to expectations. Some large buyers are coming in, but it will be two or three weeks before business assumes definite shape. Usual bar rates, 1.90c. Another shut down in nails is probable unless demand comes up better. The producing capacity is heavy and stocks are accumulating. Discounts on pipes, 70 to 75 and 10. Heavy contracts have been placed to fill requirements for natural gas wells. Smalls lots of steel rails are going at $38.50. Old rails are quoted at $23.50@$24.